# DISCOVERY

November 1937 One Shilling

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# DISCOVERY

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## Notes of the Month

Publishers to-day are complaining, with only too great justification, that their trade is becoming more of a gamble than it ever was. A huge reading public, little more than semi-literate, offers no criterion of taste on which to base the selection of books which are likely to make a living for author and publisher. This, at any rate, is the position in the world of fiction publishing; but, fortunately, the state of affairs is not quite so uncomfortable on the non-fiction side. Many publishers are courageously producing first-class works on all branches of knowledge, and, as the autumn is probably the season of greatest activity in all branches of publishing, we have chosen this month to support their effort by a special book number, with an enlarged review section and a number of articles on literary subjects. We are glad to be able to record that neither the quality nor the quantity of works on scientific subjects shows any sign of falling off.

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Dr. R. Broom of the Transvaal Museum, Pretoria, excavating in the Sterkfontein caves, near Krugersdorp, has discovered further evidence of *Australopithecus transvaalensis*, the fossil anthropoid nearly related to the famous Taungs ape-man skull, but later in date (Middle or Upper Pleistocene), of which he found the brain-cast and parts of the skull in these caves in 1936. The most important piece of evidence is a lower molar tooth, described in *Nature* of October 16th, of which the crown pattern suggests a form evolved from *Dryopithecus*, the early type of fossil ape, but at the same time agrees more closely with the pattern of an Australian native molar than with that of any of the known anthropoid apes. The possible conclusion, therefore, is that the teeth of man are evolved from those of *Dryopithecus* through *Australopithecus*, while the nearly-related teeth of the chimpanzee and gorilla represent a pre-*Australopithecus* splitting off from the same line of evolution.

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The ascent of "Shiva's Temple," the isolated block of limestone rising 1,200 feet above the floor of the Grand Canyon in Arizona, by an expedition of the American Museum of Natural History, New York, has not been productive of the amazing zoological discoveries that were predicted in certain uninformed quarters. At the same time the results recorded by Dr. Harold Anthony are not without importance. His statement that the rock is visited in winter by deer and by the larger carnivora of the district seems to compare oddly with the accounts of the utter isolation of the "Temple." He notes, however, that the smaller animals—squirrels, rabbits, and the very numerous mice—appear to be of a lighter colour than their relatives on the mainland; all of them were extremely wild and nervous of man, an unexpected trait in the circumstances. He has secured some seventy specimens of various types, which have been forwarded to New York for detailed observation.

**AUTUMN BOOK NUMBER.**

On p. 354 Sir Albert Seward contributes a special review of "*Mountains of the Moon*"; other book notices will be found on p. 357. A Special Correspondent deals with "*The Year's Photography*," a regular publication of the photographic year, (p. 353). In "*Where was Borrow's Dingle?*" Gwendolyn Thomas offers a solution of a famous literary mystery (p. 350).

From the archæological point of view, however, some interesting discoveries have gone far to justify the objective of the expedition :—to obtain evidence of any evolutionary trend in such animal life as might have survived on the plateau at the summit (an area of 275 acres) in the period that has elapsed since the pinnacle was detached from the mainland somewhere, it is thought, about the end of the Ice Age. Among the earliest observations reported was the occurrence of stone knives and arrow or projectile-points. As it had been asserted that no human foot had trodden the wooded plateau at the summit since it was first isolated, it seemed a reasonable presumption that these implements might assist in resolving the chronological problem of the antiquity of man on the American continent.

* * * *

The "Folsom point," which occurs in the south-western United States, is accounted the oldest type of stone implement yet found in America on the ground of its association with an extinct fauna, mammoth and bison, of pleistocene character. This evidence of antiquity, however, is affected by the fact that it is now generally conceded that these extinct species may have survived in certain parts of the continent for some considerable period after the Ice Age, possibly reducing the antiquity of the Folsom point to some 8,000-10,000 years. A stone industry which had survived an isolation on Shiva's Temple since the close of the Ice Age would have afforded invaluable chronological testimony. Later reports, which refer to the discovery of "Indian" mounds and ovens, suggest that the implements are relics of visits of early hunting tribes, which if not so ancient as at first seemed possible, may yet yield much desired evidence on racial and cultural succession in the early prehistory of the south-western United States, to fill the gap between the earliest Stone Age peoples and the Basket-Makers, who were the predecessors of the Pueblo Indians of the centuries immediately preceding the Spanish conquest.

* * * *

Excavations carried out during the past summer in the northern lake region of Minnesota by Prof. A. E. Jenks of the University of Minnesota have brought to light one of the most extensive camping sites of early man yet discovered in North America. It was in this region, it will be remembered, that the adolescent female skeleton, which Prof. Jenks has described recently, was found in the course of road-making operations in the bed of an ancient lake. On stratigraphical evidence this skeleton is regarded as one of the earliest authenticated specimens of early man in America. Prof. Jenks's recent discovery is an occupation site situated in the Itaska State Park. It occurs at a depth of some 3 ft. below the surface, under a bog of grasses and marsh weeds. The stratum of occupation varies from $2\frac{1}{2}$ to 4 ft. thick. No less than 2,000 bones of big game animals (including bear, elk, caribou, etc.), scored with the marks of stone implements, have been taken from the kitchen-midden material. Associated with these are the remains of an extinct bison (*B. occidentalis*), indicating the high antiquity of the site.

* * * *

At the Tenth Annual Conference for the Preservation of the Countryside, held under the auspices of the C.P.R.E. at Royal Leamington Spa on Oct. 14th—17th, Professor Patrick Abercrombie, who gave an address on "Green Belts," proposed the following resolution: "That this conference wishes to draw the attention of the cities and towns of England to the need for safeguarding the country in their immediate vicinity by means of the establishment of green belts, which serve the purposes of recreation, fresh air and amenity. This conference urges that combined financial action between urban, rural and county authorities is essential if green belts are to be permanently acquired or preserved." The problem nowadays was how to reserve farm land within easy reach of the lower-paid members of urban communities, where the people could go and look at grass and trees without a fringe of houses. He outlined the four methods of securing open country for the purpose: simple purchase, gift, agreement with the owners, and purchase of the building value. In some cases it was already too late to deal with the situation in an ideal way, therefore it was all the more urgent that what was yet possible should be done at once.

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The Agricultural Research Council have purchased from Mr. Alfred Barclay the Compton Manor Estate of about 1,500 acres, on the Berkshire Downs, about 16 miles to the west of Reading, for use as a Field Station. It is hoped to supply from Compton to Agricultural Research Institutes for experimental purposes animals of known history and free from disease; the Council are therefore also buying from Mr. Barclay his herds of pedigree cattle which have for some years been under expert supervision. All the cattle are free from tuberculosis, and two of the three herds are free from contagious abortion and mastitis. Secondly, the Council desire to fill a gap in the existing facilities for research by providing opportunities for experiments on a field scale under strictly controlled conditions.

# The Practice of Television

**By L. E. C. Hughes, Ph.D.**

*Dr. Hughes is Lecturer in Electrical Communication at the City and Guilds Engineering College, and has studied all forms of reproducing sound and scene. He here outlines the principles on which the newest type of television system, now in operation in this country, is based and suggests the lines on which it may be expected to develop.*

THE general use of a system of television, that is the distant reproduction of a moving picture or image, has been retarded on two grounds, those of finance and technical possibility. Beyond noting that television is very expensive, the technical basis must be considered first, since if an acceptable system cannot be made to work at any cost, there is no hope of its ever being put into use at all.

Since the beginning of the century there have been numerous suggestions put forward for realising the instantaneous reproduction of a moving image, but nothing was achieved until the thermionic valve permitted the control and amplification of electric currents of very high frequencies of alternation. The system now in regular use consists of two indispensable parts, the electron camera at the transmitter, with a cathode-ray tube at the receiving end, both of which depend on the control, by magnetic and electric fields, of beams of high-speed electrons, those elementary particles of electricity which more familiarly are driven round a copper circuit by a generator and, by dissipating their energy, light our lamps. These beams of inertialess particles are regulated in large vacuum tubes, and it is only within the last few years that the specific instruments have been perfected for the purpose of analysing and reconstructing an image with the requisite speed.

## Difficulty of Definition

The fundamental problem was substantially solved along other lines by Baird in this country in 1925, and, after long negotiations, the B.B.C. were induced to hire their transmitters to the Baird Company for some years so that the possibilities of the system could be explored. This regular transmission of moving pictures served to build up a body of amateurs interested in the art and science of television, but it could never be claimed that its low-definition offered any entertainment or other value which could be sold to the public on a self-supporting scale. The whole difficulty resides in the amount of definition in the picture, or, as the engineers put it, the amount of information to be transmitted in a given time.

This amount of definition is determined by the number of dot elements into which the picture is arbitrarily divided, so that it can be analysed by a scanning arrangement. When the dots are being scanned, the transmitted signal depends on the relative brightness of the dots in turn; at the receiving end the picture is reconstructed with a similar scanning arrangement, keeping exactly in step with the first scanning and at the same time providing dots which are similar in brightness to those being scanned in the original picture. To keep the two scannings in step, a synchronising signal has to be sent in addition to the signal conveying the changing brightness. In the traditional Nipkow disc method, successfully applied by Baird, the scanning is performed by a spiral of holes in the rim of a rotating disc, which cover the image line by line, slightly curved it is true, but so as to traverse the whole picture many times per second. The light passing through the holes controls, by means of a photo-electric cell, the outgoing signal. At the receiving end a similar spinning disc with a spiral of holes distributes light from a source which is varied in intensity by the incoming signal, and so reconstructs the picture. If the original picture moves, so does the reproduction, as in the cinematograph.

## The System's Limitations

The inherent limitations of such a system are, firstly, the increasing mechanical difficulties as the number of dots per second is increased, while the reduction of flicker means increasing the number of complete scannings per second, and, secondly, the amount of light for operating the photo-electric device, which is to provide the outgoing signal, also falls off inversely as the desired definition is increased.

The solution has been found in utilising an alternative photo-electric effect for absorbing the original light energy, which is normally wasted during most of the time during scanning, since one dot alone is being scanned at a time, and using this energy for generating the required signal at the instant any particular element is scanned. The mechanical difficulties are obviated by using a beam of electrons for scanning.

This idea is due to Zworykin, an American engineer. The Marconi Company, in conjunction with Electrical and Musical Industries, have perfected a system using this basic principle and this system was used in alternation with Baird's improved systems for some months at Alexandra Palace. Baird's systems were, however, of insufficient definition and their inflexibility hindered the producers, so that the Television Advisory

Committee, which regulates the development of television in this country, decided that the Marconi-E.M.I. system alone should be used for transmission. On the receiving side, the technique is more or less established and many manufacturers are making receivers.

The details of the complete system are indicated in the adjoining diagram. The image of the artist on the extreme left is focused by a lens *L* through an optically flat window *W* on a photo-electric mosaic *M* of a multitude of minute photo-electric cells. When the light from the image falls on these cells, they lose electrons at a rate depending on the intensity of the light. *M* is scanned 25 times per second by a beam of electrons *B*, which is provided by a heated surface *F* and focused to a fine point by a number of electrified diaphragms *D*; the motion of the beam to effect the scanning is governed by currents in deflecting coils *CC* supplied by a control unit. There are actually two sets of coils, one for making the beam ascend vertically 25 times per second, the other to draw it across the image 405 times for each vertical descent. For a number of reasons, this effective scheme is modified by leaving out alternate lines during alternate scans, a technique which improves the definition and reduces flicker.

### Wave Regulated by Amplifier Output

During the time that the beam is not on a particular element of the mosaic the lost charge of electrons is proportional to the light which has been falling on it. The arrival of the beam in its scanning, with its abundant supply of electrons, causes an electrical surge in the metal plate supporting the mosaic, and since the surge is dependent on the restoration of electrons, it can be amplified and form the output video signal. The wave sent out by the radio transmitter is accordingly regulated by the output of the amplifier and conveys the information from the original image to the receiving apparatus.

Since the latter must know when the picture is being scanned and when the scanning starts along a line, synchronising signals obtained from the camera control unit are added to the vision signal in the radio transmitter. At the receiving end these synchronising signals are separated from the vision signal and used to control another beam of electrons *B′* so that it keeps exactly in step with the original scanning beam *B*. The intensity of *B′* is, however, regulated by the incoming vision signal, because this carries the time-sequence of light-and-shade in the original image; for this purpose the source of electrons *F′* is enclosed in a small shield, the voltage being applied to this regulating the amount of electrons emitted through an orifice. Those which are emitted are focused, as before, by a series of electrified diaphragms.

As the electron beam strikes the end of the glass tube on the extreme right its intensity is converted into light by using a coating of highly purified phosphorescent material. Many colours have been tried, but since a good white has been achieved, this seems to be most popular; sepia and pale green have also been used and met with some favour.

For the channel transmitting the sound, and television without sound has never been proposed, a similar radio transmitter and receiver are essential. The microphone *m* on the extreme left picks up the required sounds and, after amplification, the corresponding electrical signals are used to regulate the wave in the radio transmitter, much as in normal broadcasting. At the receiving end the corresponding radio receiver and loudspeaker *S* function in the normal way.

### Handling the Cameras

To provide the subject matter for transmission, direct pick-up, artists in the studio, or previously photographed sound-film may be used; in the last case, the picture from the film is directly focused on the mosaic and so scanned, the scanning keeping in step with the intermittent film. The illumination of artists is similar to that in a film studio, and their image is easily discernible on the mosaic. The operator of the camera, however, does not observe this but frames and focuses through a matched lens system at the side of the camera.

For each unit of programme transmission, called a shot, on account of similarity with sound-film technique, several electron cameras may be in use, the producer of the programme making his selection of view by fading down the signal from one camera and fading up the signal from another before passing the video signal to the vision control engineer. The operators of the electron cameras receive their instructions through telephones, so that they can advance or withdraw their cameras (tracking) or swing them sideways (panning) as planned by the producer. The cameras are also fitted with lenses of suitable focal length for getting long-shots, medium-shots and close-ups as desired. The operator of a camera may not know exactly whether his video signal is being used by the producer any more than a camera-man in a sound-film studio knows whether his particular bit of photography will be used or not in the finished sequence of sound-film.

A second control engineer, for regulating the sound output to its relevant transmitter, is also associated with the producer and the vision control engineer in a control room high up and overlooking the action in the studio.

At the side of the studio there is a "monitoring" television receiving set, so that the floor directors and the announcers can see the outgoing programme and

time their announcements accordingly. It would be possible for the artists to see themselves in the outgoing vision programme, if they were not dazzled by the high illumination.

The conditions for the artists are very severe, since their period of action may be up to 20 minutes, as contrasted with 2 or 3 in sound-film work. Also the present sensitivity of the electron cameras requires high-speed lenses (low stops) with corresponding shallow depths of focus, so that the movements of artists are restricted to a small area. The major difficulty with the B.B.C. transmissions is under-rehearsal, mainly on account of lack of accommodation, so that there is insufficient day-to-day preparation of artists for a trying time with a new technique. A small studio in the extension to Broadcasting House, devoted to simple shots, such as talks or interviews with prominent persons, will give considerable relief to the Palace. A special cable has been laid from Broadcasting House and from a number of theatres and important locations in the West End of London, so that outside broadcasts of entertainments and public events can be readily arranged.

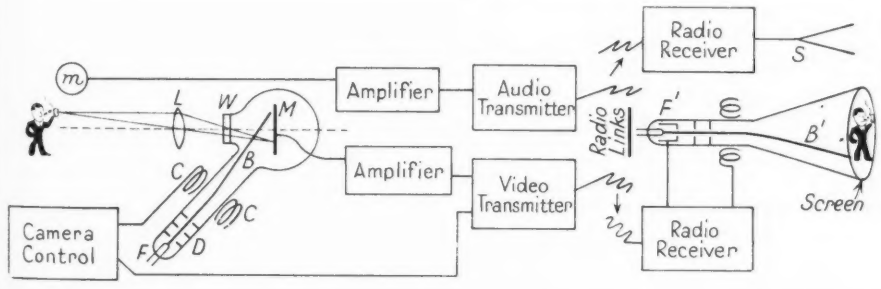
Scenes from outside the studios have often been transmitted, such as the Coronation Procession, but for more flexible use a complete transmitting plant, occupying three vans, has been equipped for picking up outside programmes and relaying them to the transmitting station proper. Television lines to Birmingham, with projected extensions to the north, will soon be ready for relaying programmes to the Midlands. It is possible that the Baird video transmitter, now not in use at Alexandra Palace, will be removed to Birmingham, since only small alterations would be required to make it radiate the signals generated by Marconi-E.M.I. cameras.

The situation in this country for television is now clear for a few years. The standardisation of one type of signal means that small economies can be made in the receivers, but, more importantly, the public is not worried with two standards, one not so good as the other. In addition, the marked reductions in the prices of receivers will assist in building up a television audience, but there must be considerable delay before anything like a reasonable licence fee from the receiving public can pay for the cost of television transmissions. Fortunately, in this country, there is a large surplus from the normal broadcast receiving licence which can be used as a subsidy. In other countries, particularly America, where revenue can arise from advertisement only, a television public has not been developed at all. A service has just been started in America by a commercial firm and in France and Germany experimental services are in operation, reception being in special receiving halls and not by the public at home, which is the ultimate aim. Events happen quickly in this field and other countries will be soon catching up with developments here.

### No Reduction in Prices

The receivers for the public are probably being sold at a loss, to encourage their extended use and so justify the great expense of the programmes. Prices will not, therefore, be further reduced for a considerable period, so that if anyone is interested in television reception there is no point in waiting, since the cost cannot be markedly reduced for some years. Neither will there be further important changes in the mode of transmission, since the Television Advisory Committee, which directs the development of the service on behalf of users, will require considerable experience before it orders any modification.

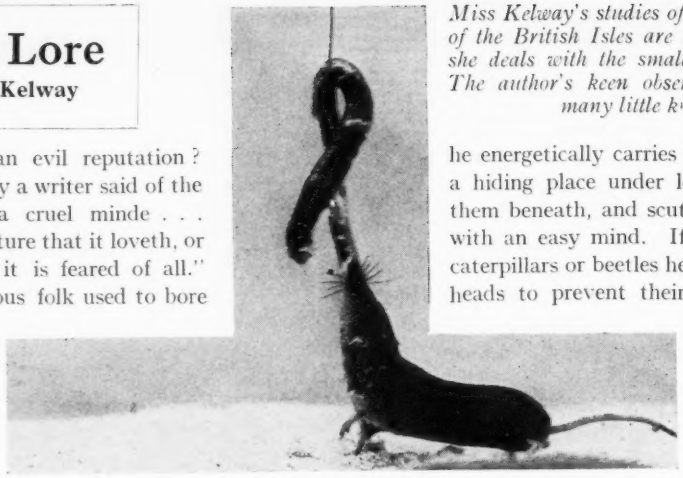
The B.B.C. are entering on this new adventure in education and culture whole-heartedly and are offering increasing value. A potential televiewer is warned against making hasty judgments after a casual inspection of television in a departmental store or café. A programme for leisure must be judged at leisure, without distractions.




*From object to image. An outline diagram showing the essential features of the Marconi - E. M. I. television system, operated by the British Broadcasting Corporation*

# Shrew Lore

**By Phyllis Kelway**



*A captive shrew retains its voracious appetite.*

*Miss Kelway's studies of the smaller mammals of the British Isles are well known, and here she deals with the smallest of all, the Shrews. The author's keen observation has unearthed many little known facts.*

Is there any end to an evil reputation? Early in the 17th century a writer said of the shrew: "It beareth a cruel minde . . . neither is there any creature that it loveth, or it loveth him, because it is feared of all." Ignorant and superstitious folk used to bore a hole in an ash tree, thrust the shrew in and plug the entrance. A twig of the tree rubbed across sick man or beast would effect a cure.

With the exception of the hedgehog, the gardener probably has no truer and more practical friend than the shrew, whose rapid powers of digestion enable him to devour many times his own weight of food within a week. Snails, slugs, grubs, worms, caterpillars, chrysalids and spiders are only a few of innumerable types of insect life to disappear down his throat. Wireworms and leatherjackets, so harmful to the farmers' crops, are eaten in vast numbers. To humanity he is harmless. Any holes he digs are too minute to cause inconvenience, and usually he sets his feet under the mahogany of field mouse or vole, who apparently raise no objections. When searching for long-tails and voles in banks, fields or hedge-bottoms where many passages connect, I frequently find shrews and long-tails, or shrews and voles, living under the same roof.

During the drought of 1934 worms could not be found for love or money, and my shrews caused me some anxiety. In desperation, one day I collected a jar full of whelks from the river, where hundreds crawled over the mud and water weeds. They were a great success and were eaten eagerly, with the exception of the shells. Large slugs are disembowelled after an excited attack with teeth and many paw-pats, but the stickiness emitted by slugs in frenzy will sometimes damp the valiant shrew's ardour. The plucky little chap gets into a panic when he finds his fingers glued together, and in his terror rubs them frantically through the earth. On several occasions I have removed huge black or brown slugs because I was afraid of the consequences when a shrew would not abandon the assault.

A glut of food is not wasted. The shrew demolishes all he can, but before retiring for his after-dinner nap, he energetically carries worms and grubs to a hiding place under leaf or stone, thrusts them beneath, and scuttles away to his nest with an easy mind. If his prey consists of caterpillars or beetles he spitefully bites their heads to prevent their escaping. Once, I watched a shrew laying up a store of caterpillars and was surprised at his cleverness in nipping the heads and *not the tails* of twenty-six that he hid under a tuft of grass. He will even disable worms with several hearty bites, but I am afraid that on awakening he must sometimes be d'sappointed, for all the world knows that a worm chopped in bits will manage to crawl away. The shrew's stores are only temporary, and I have often watched his neighbour steal the entire stock while he slept. On awakening he will run straight to his collection, a fact showing a certain power of remembrance, but I doubt whether his memory serves him for more than an hour or so. He is supposed to be fond of carrion, but although his curiosity may cause him to be caught in traps baited with high-smelling flesh, I have no evidence to bear out the supposition. Fresh meat from the butcher given to my shrews is abandoned as soon as it becomes offensive. Last summer I occasionally presented baby sparrows fallen from their nests under the eaves, thinking that a delicate dish of "chicken" would make the shrews' mouths water; but any fledglings slightly touched by the sun were ignored. A dead frog was once eaten by a pigmy shrew with great enjoyment until the white flesh grew smelly. Strange as it may seem, most flesh-eaters have a certain standard of cleanliness—not a human standard, but that of an animal. To state that they eat carrion for choice, is, I am sure, a mistake. When forced by hunger, a meal of carrion may be the only deliverance from starvation, but all shrews I have kept have infinitely preferred a wriggling worm or creeping caterpillar to the best beef fillet that had the odour of decay.

I am speaking here of both common and pigmy shrews (*Sorex araneus* and *Sorex minutus*), and this brings us to the identification of the two minute dark-coated vagabonds. Adults of the two species are distinct

if set side by side, but individuals of uncertain age being abroad throughout spring and summer, I never like to rely on length of body and tail alone. Tails often measure the same in both species, but as the body of the pigmy is smaller, his tail *appears* longer. Most tails I have measured of common and pigmy have been 30 mm. or 32 mm. The common shrew has a total length of anything between 65 mm. and 75 mm., while the pigmy shrew may be between 45 mm. and 60 mm. (taken from tip of snout to base of tail).

Body measurements are, therefore, confusing, so I depend entirely on length of sole of the hind foot, as some scientists hold that here is the only real distinction. If the hind foot measures 12 mm. or over, then the animal is a common shrew, and I think that most pigmies show a foot length of about 10 mm. without the tiny claws; 10 mm. being the average of thirty pigmies I have measured this summer. In general build the pigmy is a miniature common shrew, and it is not surprising that, until recent years, pigmies were considered youthful specimens of the larger species. The two kinds live together, and I have not learnt of any anatomical difference. Perhaps we are not yet at the end of correct classification, but if pigmy and common are really separate species, then I had a family of hybrids last June; the father's foot measuring just over 12 mm. and the foot of the mother 10 mm. The parents had been under control for more than two months before the family was born, so the argument that the mother was not mated in captivity would not help us out of the enigma. The sole of one offspring who died measured 10 mm., and I have not set a ruler to the others yet as they are still living.

### Autumn Mortality

The maximum span of a shrew's life is stated to be fourteen months, and up to the time of writing no shrew I have kept has lived beyond that period. The reason for the epidemic of shrew mortality in the autumn months has not yet been given satisfactorily. All sorts of theories have been advanced. An epidemic that slew hundreds of the tiny creatures as it swept through shrew population was generally accepted a few years ago. Most naturalists now say that these countless numbers die from natural causes, and probably in this we are nearer than ever before to a disentanglement of the reason for the high death rate. Shrews are exceedingly common, and if their lives are so short, then obviously a few thousand corpses must lie somewhere. I do not think that people realise how many millions of shrews are scuttling through the leaves and grasses of the countryside; shrews are very seldom seen alive, and as they do no damage, pass unnoticed. Long-tailed field mice are said to be the commonest mammals in Great Britain, but if pigmy and common shrew populations were thrown together I should not be surprised to know that their joint combination equalled the gathering of field mice. But why does a creature who is rarely seen out of cover in a live state, choose to lay itself upon the public pathway when death is imminent?

### Sipping the Dewdrops

Lack of drink will kill a shrew within a few hours. In the wild he sips the dewdrops from stems and grasses. Occasionally I spray the foliage in my shrew house, and have noticed that after the shower several flexible snouts are immediately poked forth to test the atmosphere. A thirsty shrew daintily laps water with a curious sideways motion of the head, not unlike a bird, but he does not usually throw back his head to swallow.

Young shrews are at first covered with a dark seal-brown fur, quite different in colour from the blue-black jacket of the first moult. When trapping shrews in the summer, many of both colours are found, but not until I had bred shrew babies did I realise that those in seal coats were sometimes less than eight weeks old. I notice, too, a light-coloured mark running for about a quarter of an inch along the upper surface of the snout, a mark making you think that fur had been rubbed from the part affected, leaving a long, narrow scar. All my young shrews were thus distinguished when they were old enough to feed themselves, and a considerable time passed before one would remain quiet for me to examine the sign at close quarters. During the first few months of a shrew's life a minute ridge of brown fur rises from each side of the snout to form a tiny elevation, like the strip of earth above the furrow thrown by a plough. When light is cast upon it the top of the snout appears as though a small wedge of skin had been removed. After the first moult in autumn a dark coat replaces the youthful brown, and it is said that in spring the coat is again changed for light summer garb. In actual fact I cannot follow this second moult. I have kept shrews through their first moult—that is from seal to black—but after the winter they have certainly not substituted the light coat again, but have passed through the whole summer and autumn in glossy black. To wear black for the long period from autumn to autumn suggests an economical shrewish method of getting the most from their mourning, for in the October and November they have invariably died. Those who study questions of fur say that shrews are not provided with a second *winter* coat, for the simple reason that it would be wasted on a corpse.

An unpleasant musky odour is a certain protection against the shrew's enemies. A gland is situated on each

flank of the males, and many animals such as cats, dogs, and foxes, who will readily kill him, will revolt against the taste in their mouths. Females appear to smell equally strong. In the casts thrown up by various owls, the indigestible remains of shrews are frequently found; kestrels too, take their toll; probably also adders, stoats, and weasels.

A few books still tell us that shrews hibernate, but the usual modern idea seems to be that they are awake throughout winter. I have attempted various experiments to see whether they follow the hedgehog or the long-tailed field mouse, with exasperating results. As long as food is forthcoming no shrew will do anything but eat, eat, and eat again, and I have not yet had the courage to withhold food entirely from creatures who were not quite independent. Shrews have hibernating glands (or fatty masses) on their shoulders, which develop in winter and disappear in spring, and if Nature is so stingy that she will not supply a second winter coat for a person who lives until November, then why has she given an order for a pair of unnecessary glands as mere extras? Considering that the ground is sometimes impenetrable as iron for weeks together, and it is hard labour for us with pick and shovel to dig worms from the frost-bound soil, what hope is there for a shrew with his weak, neurotic hands? I have on occasion caught shrews in every month of winter, even when snow has been on the ground, but all sorts of things can happen beneath a blanket of snow, which is often a protection to crawling things as well as to voles and field mice. In hard frost I rarely catch a shrew. In a recent winter I had twelve traps set in runs on a grassy piece of ground bordering a lake for about a hundred yards, where I knew shrews abounded. From December until early March I had not one bite, but on March 24th I caught a pigmy, and during the following six weeks twenty-two shrews entered the traps.

*The Common Shrew in a characteristic pose, sketched by the author.*

Far below the ground in passages and halls usually excavated by his neighbours, the shrew can be sure of warmth, even in winter but until he has learned to bottle slugs and eat canned worms, I do not understand how he appeases his hunger when frost has set the soil to solid concrete, unless his sleep deepens to the realm of hibernation. Beneath a ceiling of earth, or a tent of grass stems, the pigmy gentleman in velvet lives at the command of his vivacious temperament. His darting little eyes see only slightly better than those of the mole, but his bewhiskered snout is a receiving-set fitted to pick up any broadcast interesting to a shrew. He may be ungenerous; he may skin a flea for its hide, and scourge the very earth with his virulent tongue, but under that arpeggio of squeaks is hidden a wealth of mysterious aloof individualism, splendid to behold in a creature so small. His temper may be ostentatious and hysterical, but it has no underlay of tinsel dressiness, of tawdry decorations and unnatural show. It is real.

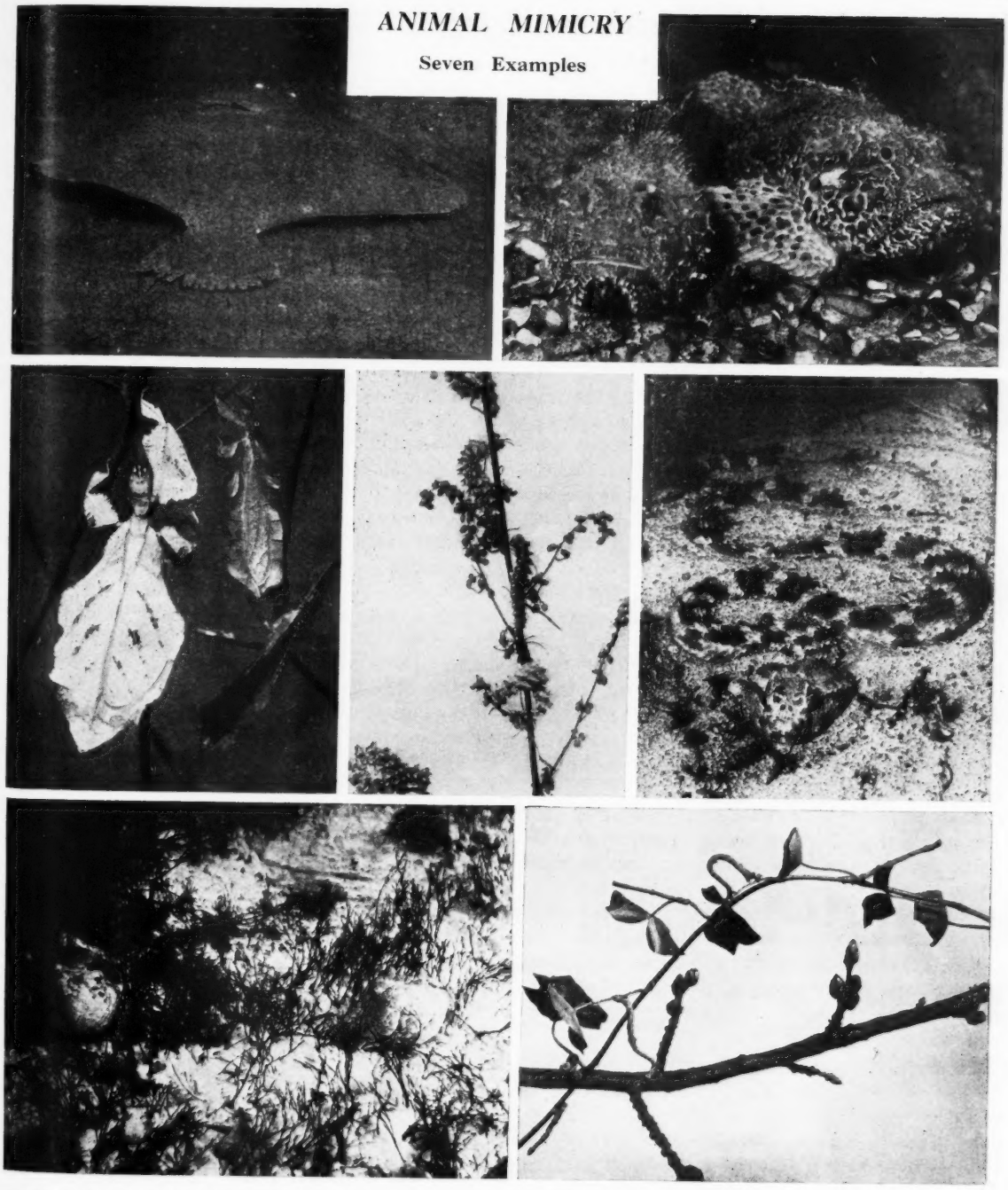
Sometimes, when I watch a shrew furiously devouring a worm, rolling it from side to side in his mouth, tearing, clawing, desperately eating, I wish for his sake that the worm could last for ever. But his temperament would never allow him a life of ease and quietude. Though the Loch Ness monster itself were laid before him in all its magnitude, he would still surely find an outlet in long, long, squirming, never-ending worms for his nervous, driving, shrewish disposition.

## Nature Observers' Calendar

*With Camera and Notebook: A Naturalist's Calendar*, published by M. C. Forrester at 3*s*.6*d*., has gathered into its wide net sixty first-class nature photographs, by British and Continental experts, embracing all types of wild life from the grey seal down to the horse-fly and from the Scots pine down to bindweed. All the species included occur in Great Britain, and each photograph is accompanied by a short description of the subject's habitat. The photographs of moths and butterflies are particularly good.

# ANIMAL MIMICRY

## Seven Examples



*Top, left: A turbot at rest; right:* Scorpaena scrofa (*"sea sow"*) *in its natural habitat (two). Centre, left: the Indian leaf-insect,* Phyllium siccifolium *(three); middle: five Emperor Moth caterpillars* (Saturnia carpini); *right: horned viper lying in wait coiled up in the sand. Bottom, left: The North European "snow-grouse," well protected in winter (two); right: five caterpillars of the Swallow Tail Moth* (Ourapteryx sambucaria).

# Spring Migration of Swallows in South-West England

By E. W. Hendy.
Author of "The Lure of Bird-watching," etc.

*One of the most important aspects of bird-migration is the question of routes, and here Mr. Hendy sums up the evidence from four years' study by various observers in that part of England first reached by many swallows in spring.*

IN DISCOVERY for March, 1935, I described the spring migration of six species of birds, wheatear, chiff-chaff, swallow, cuckoo, common whitethroat and spotted fly-catcher, observed in 1934 in the Western Peninsula, in accordance with a scheme organised by the Bird-watching and Preservation Societies of Devon and Cornwall in co-operation with the *Western Morning News*. In the subsequent three years, 1935 to 1937, similar observations have been recorded by members of the same societies and others with regard to the swallow. A comparison of the movements observed during this series of years enables us to form a fairly good idea of the spring swallow migration in Devon, Cornwall, and West Somerset, and in this article I have briefly summarised the results.

First, as to the duration of swallow migration: this shows a rather surprising uniformity, for in each of the four years it has lasted two months. The respective dates are:—1934, March 29th to May 27th; 1935, March 29th to May 28th; 1936, March 22nd to May 31st; 1937, March 19th to May 19th. A single "freak" swallow seen on March 4th, 1935, near Torquay, may be disregarded. Generally, swallow migration in the west extends from the 3rd or 4th week in March till the 3rd or 4th week in May.

Each year the early arrivals of swallows are few; it is only later on that there are especially active periods, during which the birds come in waves or rushes. These occurred in 1934 from April 15th to 22nd or 23rd, in 1935 from April 6th to 23rd, in 1936 from April 10th to 27th and on May 9th and 10th, and in 1937 from April 9th to 13th and 23rd to 27th. In every year smaller rushes occurred as well on other dates.

### Weather and Migration

It is difficult to synchronise these rushes with weather conditions. As I pointed out in my previous article, the major factors in migration are the meteorological conditions where the flight begins: if birds arrive when circumstances here are adverse it is probable that the flight started when conditions were favourable but deteriorated *en route*. In 1934 and 1935 detailed meteorological reports in south-western England and Europe were kindly supplied to me by Mr. G. M. Spooner of the Marine Biological Laboratory, Plymouth, but in 1935 and 1936 the weather information which I received was more meagre. I have, therefore, confined my comments on the effect of weather on the swallow migration to the two former years.

In 1934, during the "rush" period from April 15th to 22nd or 23rd, the weather was generally unsettled. Westerly winds predominated in western France and the English Channel, but some nights were fairly propitious for migration. On the north and north-west coasts of Devon and west Somerset, and in some districts of Cornwall, and mid and south Devon, there were cold northerly or north-westerly winds from April 19th to 22nd. During the period from April 30th to May 4th there were northerly winds, with temporary changes to westerly: yet from May 1st to 4th there was a marked movement of swallows to the north-east along the north-west coast of Cornwall. From May 7th to 13th conditions were anticyclonic, with negligible winds and a higher temperature. Near Torquay there were numerous arrivals on the 8th, 11th and 13th, and on the 10th there was a continuous northward drift of swallows along the cliffs between Morwenstow and Hartland, which continued more sparsely on 11th and 12th.

### Arrivals in Bad Weather

In 1935, during the "rush" period from April 6th to 23rd, complex low pressure systems with alternating ridges of comparatively high pressure prevailed over Britain and the Channel area, causing changeable unsettled weather, though there were bright intervals and clear periods on some nights. There was a large passage of swallows along the north-west coasts of Cornwall, Devon and west Somerset, from Cape Cornwall to Burnham on 8th, 9th and 10th, though the weather at this time was unfavourable both in the Channel and west France, with south-west winds and rain. There was another rush which began on the 11th and continued with varying intensity until the 16th: the principal movements were in the Exe Estuary and at Ilfracombe on the 11th, at Bideford on the 12th, and near Torquay on the 13th and 15th: two swallows were seen at sea, four miles off Budleigh Salterton, on the 14th, but reports came from all over Devon and a few from Cornwall during this period. Small parties arrived at Lundy Island on the 12th and 14th. There was better weather

in the Channel and west France on the 11th and 12th and on the nights of the 14th and 15th.

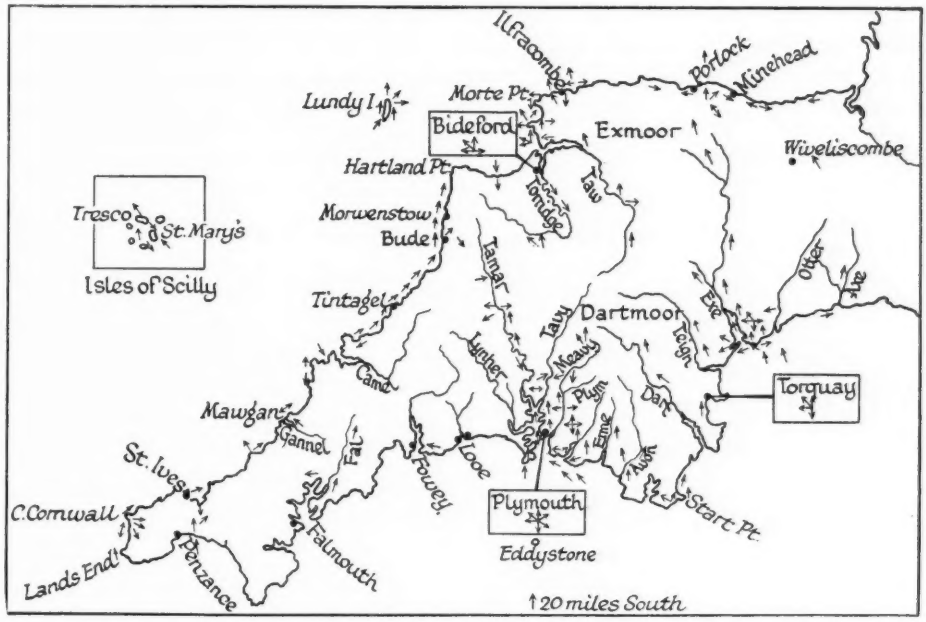
On the 17th few arrivals were recorded ; strong west wind with rain prevailed in the Channel, west France and Spain. There was an improvement on the 19th in west France, with a light south-west wind, and swallows appeared in small numbers in various localities in Devon. From the 20th to the 22nd, though the bad spell continued, there was calm weather in west France : on the 20th a flock arrived from over the sea at Noss Mayo, in south Devon, and swallows were passing up the north-west coast of Cornwall all day : on the 21st there was a rush at St. Just in south-west Cornwall.

On April 22nd a thin continuous stream of swallows passed over Lundy Island from south-west to east or north-east, and numbers were travelling up the north-west Cornish coast. Arrivals on the 23rd were fewer.

### Strong Flight of Swallows

The foregoing comparison of weather conditions and rushes seems to show that, though migrating swallows generally take advantage of favourable weather, they sometimes cross the Channel when meteorological factors are adverse. High winds are unsuitable, but a light or moderate wind, even if contrary, does not seem to hinder their passage if other circumstances are propitious. Swallows are strong fliers. It must also be remembered that much migration takes place at a great height, and at these higher altitudes bird travellers may reach favouring air currents. Nor do we often know the nature of the wind and weather at the starting point of their journeys.

As I mentioned in my previous article, some ornithologists hold that birds follow definite flylines or routes : others believe that they travel on a broad front over all the country lying between their breeding and winter quarters. I do not see why both theories should not be correct. But the four-year records show that in the western peninsula many swallows take well defined routes.




*Map of Cornwall, Devon, and West Somerset, showing the principal spring migration-routes of swallows, 1934-37.*

### The "West Coast Route"

These routes present some interesting problems. The "West Coast Route," which probably begins at the Isles of Scilly, passes along the north-west and north coasts of Cornwall, Devon and west Somerset. In each of the four years there are numerous accounts of swallows arriving as far south as the Isles of Scilly and passing along this route to the north-east or east. But there are deviations ; in 1934 eleven swallows departed from Tresco, Isles of Scilly, in a south-easterly direction, a course which would take them to Ushant on the Breton coast. Did they there join the continental migration route which skirts the western coasts of France, and proceed northwards ? Again, in 1936, some swallows departed north-west from the Isles of Scilly, a direction which would lead them to Ireland.

Also, in 1934, a swallow flew north-west from St. Agnes,

on the north-west Cornish coast : the nearest land in that quarter is Ireland. In 1935 and 1936 on the west coast of Cornwall, north of Land's End, swallows were seen flying in a southerly or south-easterly direction : these birds may, on reaching the shores of southern Cornwall, travel northwards along that coastline. In 1937, near Newquay, parties of swallows were flying down the coast to the south-west against a stiff south wind and rain. Possibly these were turned back by the weather.

In 1935, 1936 and 1937 there were records of swallows flying south-west, south, or south-east from various places on the north-west Cornish and north Devon coasts ; certainly some of these travel southwards up the Taw and Torridge valleys. The inference is that some swallows turn inland from the West Coast Route ; others leave the West Coast Route at various points on the north Devon coast and fly westward to Lundy Island, where they have been seen arriving. Others, again, turn away from the north Devon and west Somerset coasts in a north or north-westerly direction, a course which would bring them either to Ireland or the south coast of Wales. Thence they may join the well-known migration routes along the western shores of Wales or the east and west coasts of Ireland. In 1935 most swallows reached Lundy Island from the south-west and left to the east or north-east : the former would tend to join up with the easterly route along the south side of the Bristol Channel, the latter would reach South Wales.

### Double "Bristol Channel Route"

The records for all the four years again reveal that there is a passage of swallows both east and west all along the southern shores of the Bristol Channel from Porlock to Morte Point, west of Ilfracombe. Many of those flying east along this route are continuing their journey by the West Coast Route, but others, and also many of those proceeding westward, must have come overland, some by river routes from the south Devon coast, mentioned later, and others directly across Dartmoor, Exmoor, and east Devon. There are definite records of swallows flying north and north-west at Black Torrington in the Torridge valley towards the north-west Devon coast, and from the Yealm and Erme valleys in south Devon round the west side of Dartmoor. Some have been seen passing over Dartmoor and Exmoor at altitudes of 1,000 to 1,500 feet and others going north-west near Wiveliscombe.

Turning to the south and south-east coasts of Cornwall and Devon, there is evidence of swallows migrating northwards up the St. Erth valley from Mount's Bay to St. Ives, up the Fal valley, and overland near Grampound. The five rivers—Lynher, Tamar, Tavy, Plym, and Meavy—which eventually debouch into Plymouth Sound are all popular swallow highways : two swallows at sea on April 2nd, 1937, twenty miles south of the Eddystone, flying north, would reach land at Plymouth. The general direction of flight here is north, north-west or north-east, and the same is true of swallows following the Erme and Dart rivers, those reaching the coast near Torquay, and others passing up the Exe estuary and valley (a very crowded highway), and also up the Otter. Two were seen separately at sea, four miles off Budleigh Salterton, April 14th, 1935, flying north-west.

But there are a good many reports of other swallows flying roughly east or west along the south Cornwall, Devon, and Dorset coasts, near Mount's Bay, Plymouth, at Start Point, on the Exe Estuary and on the Fleet near Weymouth. These birds seem, on arrival, to coast along our shores, but it is impossible to conjecture their ultimate goal. Some may eventually turn northwards either up the river valleys or overland.

### Submerged Coastline

A possible explanation of the origin of the West Coast Route suggests itself to me. Any physical map of the British Isles and France shows that the fifty fathom line runs in a broad curve to the east and then to the west from the Isles of Scilly to Ushant on the west coast of Brittany. Within comparatively recent geological time this must have formed the coastline of south Britain and west France. We do not know when bird migration began, but it is probable that in those days migrants followed that coastline. Do they still unconsciously do so ? It is significant that such a route would guide them to the Isles of Scilly and thence to the present West Coast Route.

It might be possible in the future to trace this West Coast Route still further if collaboration with ornithological societies in south and west Wales could be established.

## Distribution of Birds

Readers who have been interested in the above article, and the article which follows, both dealing with the movements of birds in and around the British Isles, should not fail to note in our forthcoming December issue, an account, by that well known north-country observer of bird life, Mr. Eric Hardy, F.Z.S., of the distribution of certain typical British birds. As a result of suggestions made by the British Trust for Ornithology, the subjects chosen for the 1937 study were the coot, the magpie, and the red-backed shrike ; the collated results of the observations made will be found to be of the highest interest.

# Notes on Bird Migration

**By A. R. Tripp**

*Mr. Tripp, who has been an officer in the Merchant Navy since 1922, has enjoyed unrivalled opportunities of studying the migratory movement of birds across the ocean. His observation points away from the commonly accepted theories of migration and opens up new theories demanding further investigation.*

It is not within my power or the scope of these notes to deal with the maze of argument and conjecture, reasoned and unreasoned, which surrounds the question of migration. Indeed, the space would be better occupied by an apology for the mere contemplation of adding still more to the crowded literature of the subject. I have but one excuse: that I hope to foster interest in an aspect of migration which has recently been receiving very serious consideration at the hands of many in the ornithological world who are a great deal more capable than myself.

Mr. E. M. Nicholson says that the chief thing in which all ornithologists are consistent is that they never agree. Perhaps this is partly because their deliberations in the field of migration—and I feel sure that he chiefly refers to that department—have hitherto been of too mundane and superficial a nature to be adequate, and hence consistent, when dealing with a problem so profound and obscure.

### No Simple Explanation

Unfortunately for the simplifiers, migration would seem to require two sets of explanation, neither of which will stand by itself. The obvious and cruder solution—the "sex-food-climate" theory—beset by long-standing objections, falls short not because it is wholly wrong but because it seeks to account, with its one set of more obvious reasons, for something which is probably governed by one or more distinctly separate and deeper principles. The evolutionary maxim of the perpetuation and advantaging, by change of environment, of creatures whose physical equipment so especially facilitates nomadic habits, may be applied to bird migration as an ultimate and instinctive "purpose," or resultant, but something is still required to explain the *immediate cause*, which simultaneously impels migrating birds with such unfailing regularity. Seebohm said: "The desire to migrate is a hereditary impulse, to which the descendants of migratory birds are subject—a force almost, if not quite, as irresistible as the hereditary impulse to breed in the spring." He at least distinguished the two distinct and separate impulses here, and split up the begin-all and end-all solution based on sex, food and climate which has been with us for so long. The subtle problem of the initiation and simultaneity of migration cannot as yet be placed in any scientific pigeon-hole.

There are grave objections which discredit, as a complete explanation, the unassisted sex-food-climate theory. Confining ourselves to the northern hemisphere, the following are some of the major ones:—

(1) Most birds start south in the late summer or autumn before there is any serious diminution of the food supply or marked deterioration of the weather conditions in their summer quarters. In the spring, some begin to arrive at a time when the food available is inferior in quantity and quality to that which they have forsaken.

(2) Some insectivorous species begin their journey towards the end of July, when both food and weather conditions are at their most favourable for a continuance of their stay.

(3) Many traverse, on their journey north or south, areas which would be perfectly able to support an abundance of bird-life, but which they entirely neglect.

(4) Large numbers of our summer visitors are sexually immature, and hosts of others are sexually mature but make no attempt to mate, nest or breed during that season.

### Physical Impulse Not Enough

Without going into the many other more complex objections to the simple theory it is evident that one cannot unreservedly explain by physical promptings alone the wholesale nature and baffling regularity of this grand transfer of life and matter.

It has been argued that the birds' fallible intelligence could be responsible for some of these phenomena—that they are liable to make mistakes just as we do ourselves. Imagine, though, what would happen if the birds were of a sudden robbed of the powerful "instinct" (for lack of a better term) which plays so great a part in their lives, and that they were left to carry out their migration by means of true reasoning power alone. It would not be long before the countryside would be bearing silent testimony to the disastrous result. Intelligence is a quality of which too generous a measure has been "wished on" the birds by kind-hearted ornithologists of the sentimental school. It is a point regarding which there has been much loose thinking. As it

is, a daily increasing mass of evidence emphatically indicates an almost complete lack of reasoning power in most animals. Tests carried out upon such as are considered to be fairly high in the scale of intelligence have gone far to show that even in these cases the powers of pure reasoning are relatively infinitesimal. The intelligence of birds, at its best, is so limited that the very success of their migratory ventures precludes the possibility of reason being in any great degree a guiding principle.

### Avian "Character"

Mr. Nicholson, speaking of the "character" of a bird, says: "It is essentially a slave, being incapable of reflection except in the most primitive sense and entirely at the mercy of a series of delicate yet not especially subtle trains of behaviour, to which the circumstances of the outer world are perpetually acting as a stimulus or 'trigger.' A human being who possessed the mentality of a bird would be considered irresponsible, unintelligent, but gifted with inexhaustible intuitions, quite lacking in character but ready and alert, unimaginative, and entirely without any morals."

In the February, 1934, issue of the American magazine, *Atlantic*, Mr. Charles D. Stewart gave an interesting and amusing account of how he helped an American robin (*Turdus migratorius*) to build her nest. He advanced the experience as evidence of the bird's intelligence. The robin, he said, had chosen as a site for her nest the upper angle formed by the projecting ends of two wooden posts nailed together to form the rectangular arch of a gateway. The wind was very strong and all the straws or twigs which the robin first placed were immediately blown away. She met this condition by poking the pieces of dry grass down into the cracks in the posts and after this the building proceeded more rapidly. "This robin," says Mr. Stewart, "when the wind blew her materials away, knew how to handle the situation." After this, however, further trouble beset the bird. A pair of sparrows began carrying away for their own use the pieces of the uncompleted nest as fast as the robin deposited them. They came back time after time while she was away, so that she made no headway at all.

At this juncture Mr. Stewart intervened. He made a nest of about the robin size, mostly with coarse, stiff grass and small twigs; he also worked in some sphagnum moss and a few pieces of white cotton string—though he concluded that this last was "very poor practice," having noted since that robins do not use such flimsy material in the body or bulk of their nests. When he thought that his nest was "good enough to lay eggs in," he waited until the robin had departed and hastily anchored it firmly in place, retiring to watch with amused anticipation the effect upon the bird. How would she behave when she came back and found all that had been accomplished in the few moments since her departure?

The robin duly returned and, after a "very little inspection" of Mr. Stewart's handiwork accepted the nest as a whole. Nevertheless, she "... corrected mistakes here and there. She would take a loose end and poke it right into or through the nest, and take another piece and weave it up into the edge, and so she worked away for quite a while. With this done, she flew away and came back with a little pile of mud on the end of her bill; and she kept this up till the interior had received the usual coat of windproof plastering. Then came the finer lining ... a very little of this being required. A clutch of eggs was laid and a family of robins successfully raised."

Mr. Stewart then proceeds to argue in favour of intelligence, developing the idea that any suggestion of "step number one" being followed by "step number two" and so on, in an ordered sequence of instinctive nest building, was here absent. He says that there was no carrying out of an automatic record on the brain, which instinct is supposed to be. He concludes by asking: "What bird ever had such an experience before—or how often in the course of history? Yet she dealt with it."

### Dealing with Emergencies

Let us take, first, the robin's action in order to cope with the strong wind. A strong wind is not an unusual phenomenon, and surely the straws were tucked into the cracks because, through evolution—which is as old as the winds themselves—birds have become adapted to deal with such emergencies. Winds, after all, are not true emergencies, but specific conditions, obtaining as frequently as those customary during better weather. A bird does not, for example, always obtain its food at the same time, in the same spot and under the same conditions; yet each separate situation is handled readily enough simply because evolution, far from being a force of initiation, is the helpless, though unerring, tool of circumstance.

The bird's finding of the almost completed nest must certainly have "seemed strange" to her in so far as that sentiment could be experienced by her intelligence; but the nest was there, and so why should she destroy it? It is true that there may not have been any ready-made instinctive code of action for dealing with what, in this case, was a true emergency, but there was infinitely less to indicate that an actively objective course should be followed by decisively pulling the nest to pieces and starting again. If the robin *had* destroyed

it there would have been a far better case for intelligence. There is no clear evidence here for attributing to the bird any mental experiences of a truly reasoning character.

In the lower grades of life, existence and development are governed chiefly by "conditioned reflex"—a modernised term for instinct—with no, or very little, intelligence and reasoning. In the scale of life the proportion of reason to instinct is in inverse ratio; thus, when the reasoning powers are great, as in man, the mind is less responsive to outside influences or reflex stimuli such as those which govern the whole existence of lower grades of life such as insects, fishes, birds, the lower mammals and so on.

In a popular lecture on *Ants and Men*, Professor Julian Huxley said that Maeterlinck's view, supporting insect intelligence, was quite erroneous. The white ant, Huxley said, was not cleverer than human beings. These insects did not consciously control their lives and actions, which were determined solely by heredity and evolution. The ants relied mainly on instinct while we relied on learning how to do things. As a result of that reliance on instinct the ants had nothing like tradition; they began again every generation anew, where the former ones started from, and they could change their ways of life only very slowly through natural selection, whereas we could transmit our experience and change very quickly. The ants seemed to have finished their evolution, whereas man was just about beginning his. This was proved, so far as the ant was concerned, by the occurrence in amber which was at least 20,000,000 years old of ants beautifully preserved with every detail of their structure, and these ants differed in no particulars at all from the ants of to-day. Modern man was only a few hundreds of thousands of years old. We and most of our mammalian relations had a capacity for learning by experience dependent upon the size and complexity of our brains. A small number of rigid channels of behaviour, which were the basis of instincts, were all that the brain of the ant provided for. Also, we were self-conscious, which the ants could not be. All other animals were merely blind products of evolution.

### Response to Reflexes

Nevertheless, to return to our subject, response to reflexes still persists in ourselves to some extent, especially in time of unprepared emergency such as at the sounding of a motor-horn as we cross the road, causing us to leap involuntarily for safety without consciousness of any reasoned action. The leap, or the turn of the head in order to see what is approaching, is practically simultaneous with the sound of the horn—much more so than we could ever achieve by reasoned, voluntary effort. When we hear it, perilously near, we are thrown without warning upon our emergency resources, passing through a momentary atavism, our reactions being similar to those of our animal ancestors—the safety of whose lives so constantly depended upon the instantaneous application of these resources to the urgent needs of self-preservation.

In so far as the action is a reflexive or instinctive one we behave identically with the moth flying to the light, the spider weaving its web and, as I believe, with the bird which builds its nest, courts its mate, or sets out on a migratory journey. *Each manifestation of such a type must have its complementary stimulus or set of stimuli*—and we have still to seek that stimulus which, periodically, impels the wholesale bird movement which we call migration.

The performances of the moth, spider and bird, or of the hibernating insect or animal—this latter being nothing more than a restricted form of migration—are also emergency measures, but of a less immediate character. All life, right through the scale, is a series of emergencies of varying urgency. Man now deals with many of these by reasoning; but the reflexive process of involuntary self-preservation, the most urgent and constantly needed of all, has persisted throughout the vast lapse of time which separates us from our lower relations. Nature, superficially beautiful but obscurely and profoundly ugly, keeps her lesser children in a continual state of mutual hostility, leaving them little time for anything but the search for food and the destruction of their enemies.

### Sense of Direction

By virtue of his reasoning powers man claims superiority; yet superiority is but relative and, indeed, in the light of certain comparisons he can be shown to be definitely inferior. Mr. T. A. Coward, dealing with birds' power of orientation, says: "Human beings, in varying degree, possess a sense of direction, and some a wonderful power of finding their way in strange places; it is most marked amongst men we choose to call uncivilised, who, indeed, live in closer touch with nature than those of us who depend so much on compass, map, road, train, and tram; we, as path-finders, are degenerate. Middendorf marvelled at the power of the Samoyeds, but when he questioned them was met by blank surprise, and the cross-question: 'How does the little Arctic fox find its way aright on the great Tundra?'"

It seems evident that in human beings, through the ages of evolutionary development, the intuitive faculties and the ability to respond to possible external stimuli have become reduced to a minimum. Thus, in this

respect we may be considered as inferior to most other living things. Deficient in intelligence but efficient in response to reflex stimuli, birds have no need of compasses on their journeys, and we still have no inkling of the explanation of their extraordinary powers of orientation or of the quality of great physical endurance and resource which they apparently acquire during migration. Sea birds, in particular, and quite apart from migration, possess astonishing endurance and stamina, battling for days and nights continuously with the fierce, icy gales of, say, a North Atlantic winter.

Science, nowadays, approaches her problems with a humbler and more open mind, each apparent advance seeming merely to increase the complexity of the puzzle. She tends towards a subjective reasoning and is now not so chary of giving patient consideration to possibilities and hypotheses which would earlier have been consigned to the realm of the crank and fanatic.

At the moment, with an ever-broadening outlook, scientists are devoting some speculative thought to the possibility of the control of the origin, development, and progress of life by cosmic radiations or influence from outer space. Sir Francis Younghusband, in his impressively reasoned work *The Living Universe*, enlarged greatly upon this idea and, while it is difficult—but not by any means impossible—to accustom oneself to his final somewhat tentative suggestion of a kind of central controlling planet, yet the body of the work undoubtedly "gives one furiously to think."

We have seen that the lower the quota of intelligence in an animal the greater will be its susceptibility to outside influences and its "ability" to react involuntarily to these. The possibility of some cosmic influence being the guiding principle in the migration of birds is a field of investigation which has, perhaps, been too much neglected hitherto. The obvious and more mundane "explanations" of the migratory manifestations which we see around us have blinded us to the possibility of more subtle and original causes.

### Flight-Unison

A further interesting point is that no satisfactory explanation has yet been advanced to account for a well-known but striking phenomenon which I shall, for lack of a better or recognised term, call "flight-unison." It is a common sight and may be exhibited by any number of birds from two up to a large flock of some hundreds when they are flying in one definite and relatively compact party. In its most striking form there is usually no evidence of leadership, and it is remarkable to see a large party turn and twist with absolute unison in a series of complicated evolutions often lasting for many minutes consecutively. Sometimes it would appear that a "mistake" is made, and one bird, or a whole section, will become separated from the main party.

### Failure of Directive Mechanism

Once, when I was watching a flock of pigeons performing a typical series of such "aerobatics," the directive mechanism, whatever it may be, seemed momentarily to fail in keeping the entire flock in unison, and on an instant it divided into two approximately equal halves, but leaving three "odd" pigeons midway between the two sections. The direction of flight of these birds immediately became erratic and its style jerky, as though they were helplessly torn between the apparently equal "pull" of the two main flights. There was no indication of decision in their behaviour and, had the two main parties continued in the same direction and relation to one another, it would have been interesting to witness the outcome. The flock on their left, however, made a sudden right-angled wheel and the three stragglers were re-absorbed into that party. The antics of the separated flocks were continued for half a minute or so longer, each now appearing to be a separate entity as regarded the character of its evolutions, but each individually exhibiting the same amazing simultaneity of movement until both came to rest upon the roof of a house, the two flights alighting within a few seconds of one another. Such occurrences may be multiplied almost indefinitely and with all species, and I believe it possible that they are of some importance as minor symptoms of the grander and larger-scale exhibition of migration.

It may not be a coincidence that pigeons, whose amazing homing instincts and power of orientation are so highly developed, should display this flight-unison to such a marked degree. It seems possible that the two are in some way linked, and that in the homing pigeon we have an instance where receptiveness to external stimuli is constantly present, has become distorted in some way by man's unconscious agency, and is physiologically independent of the factors which determine the periodical nature and migratorial outcome of such impulses in its less domesticated fellows.

### Experiments with Seabirds

Elaborate experiments with noddy and sooty terns, carried out in the United States by Drs. J. B. Watson and K. S. Lashley, showed that these birds have a strong homing instinct and there seems to be little doubt, as a result of their work, that sight—and thus, one might conclude, recognition of objects, or memory in the ordinary sense—has little or nothing to do with this faculty. Again, the true "deep-sea" birds, such as

the shearwaters, fulmar petrel, skuas and kittiwake, see no land whatsoever for the greater part of the year, and yet, in their regularity of seasonal movement and certainty of direction they are as infallible in the main as are the land birds.

I have heard that W. H. Hudson related an incident regarding a cuckoo which he kept for some time in a cage. One day in July—at about the time when cuckoos begin their southward journey—he found his captive in a kind of trance. It was trembling violently and there was continuous vibratory agitation of its wings, suggesting an instinctive urge to flight. After recovering from this condition it appeared to be perfectly normal in every respect. I do not know for how long the " trance " state lasted and it is unfortunate that there are not more details of the occurrence. It would be interesting to know if anyone has read of it or has himself noted such an incident.

It is easy unconsciously to take for granted that each bird has its individually separate instinct to prompt its migratory movements. I think that this may not be true and that migration may have to be regarded as one inclusive and roughly simultaneous impulse ; a sympathetic movement of the whole : " flight-unison " on a grand and staggering scale ; the result of some external influence affecting simultaneously all the birds within its scope.

### " Trance " Condition

The possibility of such an all-impelling and singly-purposive " outside " force seems further to be suggested by the fact that migrating birds are inexplicably averse to food and water when on their journey. Some kind of " trance " condition might account for this. At numerous times I have seen tired migrating birds alight on a ship at sea and take not the slightest notice of such food and water as was offered, though sometimes remaining aboard the vessel for days at a time. In due course they either leave the ship, presumably to continue their hazardous journey, or finally succumb to starvation and thirst aboard.

The congregation of certain species, such as the missel thrushes, before migration, might indicate the taking of an instinctive precaution, born of evolutionary development and selection, being necessitated in such species by some deficiency in their reaction to the influence. In this manner they would concentrate it as much as possible before venturing upon their journey. Different species would be differently affected according to physiological development. The " radiations," whatever they may be, would make themselves felt soon or late, strongly or feebly, according to the species. Thus, the yearly sequence of arrivals and departures, more or less regular, would be manifested as we now know them.

May it not be that this immediate impulse to migration is a force which originates in outer space : an intermittent but regular form of radiated energy complying, in its cyclical character, with all the other recurring phenomena of nature ? As Younghusband suggests, an influence such as this may conceivably affect all living things, the universe being akin to a complete and living " body " with all the recurring functions of such, any single organ of which can affect all the other organs and which, as a whole, can itself influence a particular part. Such cosmic influences or inter-universal reactions, themselves perhaps varying through the ages, perchance controllable and able to be re-radiated and utilised according to the balance of intuition and intelligence in those who are subject to them, may have operated since the beginning of time.

### A Common Heritage

Life, evolving slowly from the primordial germ to the shapes in which we know it to-day, keeping pace with the infinitely gradual geological and climatic changes in our world, has progressively adapted itself to its environment. Man, unique in the pageant, " the conscious trustee of evolutionary development,"* possessed of a minimum of intuitive receptiveness and a maximum of its reciprocal intelligence, must hew his own way through the jungle, apparently unassisted, except in sudden and potentially dire emergency, by this mysterious force which I have imagined. By his too rigid devotion to reason he may be unconsciously combating the intuitive guidance which could, judiciously allied to his very intelligence, perhaps reveal so much to him.

I cannot do better, in conclusion, than to quote Mr. Coward once more : " With the birds, and the insects and plants upon which they feed, we share a common heritage, and the more we learn of the life of these, our fellow workers, the nearer we approach solution of the great riddle of the Universe, the mysterious law-abiding scheme of Nature."

## Bombing the Terns

According to the writer of a letter to *The Times* last month, the common tern would appear to be in serious danger of extinction in England. Three of its principal nesting colonies are, or were, at Dungeness, Orfordness, and Chesil Bank. That at Dungeness is rapidly becoming encroached on by buildings ; Orfordness was taken over after 1920 by the R.A.F. as a practice ground ; and now Chesil Bank is going the same way. Where will the terns betake themselves to escape the bungalow and the machine-gun ?

* J. S. Huxley.

# GREENSTED CHURCH

**By Wilfrid McWilliam**

*Though within easy reach of London, this sole surviving example of the log-built churches, once common in the forest region of Essex, is not as well known as it deserves to be. Yet it played an interesting part in early English history.*

THE building of religious establishments in early Christian days was largely a labour of love, as opposed to the construction of castles and other fortified places by forced labour. Local materials were drawn upon for church building merely for reasons of economic necessity. According to the Venerable Bede: "There was a time when there was not a stone church in all the land but the custom was to build them all of wood."

Essex in early days was one of the best wooded English counties so that it is not surprising to find there this unique example of an early wood-built church—the parish church of Greensted.

The original building, which constitutes the nave of the present church, was put together to shelter the body of St. Edmund on its way from London to Bury in 1013. St Edmund reigned in East Anglia from 855 until 871, when he was killed by the Danes. His body lay buried at Thetford for thirty-three years, but was then removed to London for fear of further spoliation by the invaders.

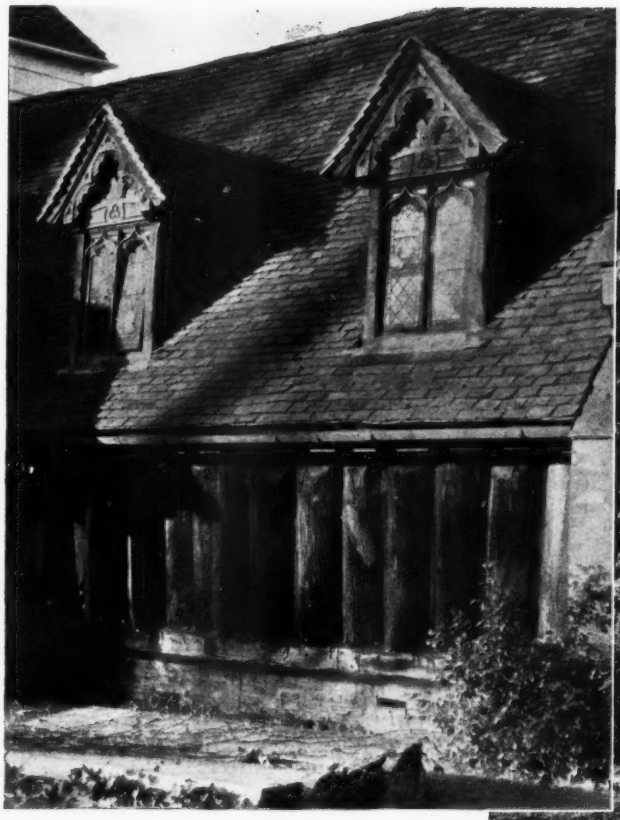
In an old MS life of St. Edmund preserved at Lambeth Palace and in another quoted by Dugdale in the *Monasticon*, it is said that the body was returned to Bury after the Danes had been expelled from the country, and rested for a while in a wooden chapel near Aungre (*i.e.*, Ongar). It is now accepted by archæological authorities that Greensted Church is the wooden chapel referred to.

The little church as it now stands is a link between Saxon times and the present day. The walls of the chapel consisted of stout oak trunks split in twain and set upright in the ground on a wooden sill to which they were mortised and pegged. The flat face was turned inwards to form a smooth interior wall but the four corner posts had only a quarter segment cut out of them in order to provide the soundest possible construction under the circumstances. These corner posts are still in position to this day.

Early in the reign of Henry VIII a red brick chancel was built at the east end of the original chapel and early in the 17th century the charming wooden belfry was added at the western end. It contains only one bell inscribed: "William Sand made mee 1618."

In the year 1848 a thorough restoration became necessary; the lower ends of the timbers forming the walls of the nave had decayed through contact with the earth, so that it was deemed advisable to shorten them and make up their original height by a brick plinth. On the south wall a length of about two feet was cut off but very curiously the trunks on the north wall have only lost about six inches.

It is a matter of regret that the trunks at the west end were needlessly removed when the belfry was built. It is true that more light was admitted to the church through the fine new west window added at the restoration but a compromise might well have been effected. The restoration of the church excited national interest and a paper relating to it was read before the Institute of British Architects in 1849. A curious fact came to light during the proceedings. It appears that an ugly coating of plaster was stripped from the interior of the nave revealing traces of an early system of torch lighting. The timbers showed signs of scorching at points where it was evident that lighted flares moulded into lumps of clay had been stuck on to convenient points on the walls. The plaster has now been removed and the flat surface of the tree trunks cleaned and polished.



*On the left, a close view of the rough-hewn timbers of the nave wall, with Tudor dormers above ; on the right, the Tudor brick chancel.*

Another discovery made at the time of the restoration was that of a flat hearth of burnt clay in the centre of the nave opposite the porch. An open log fire had evidently been kept burning there for some considerable time, the smoke finding an outlet through holes in the roof.

It is not recorded anywhere for what length of time or for what reason the body of St. Edmund was " rested " at Greensted. It may, however, be imagined that a sort of lying-in-state took place whilst the coffin lay there and that the burning torches and the open fire really formed part of the ceremony.

The present picturesque tiled roof and dormer windows are thought, because of certain resemblances to the chancel work, to date from Tudor times also. The original roof of the Saxon chapel was almost certainly of wood, probably with ventilation ducts or cowls of a shape which may have suggested to the 16th century builders their idea for the dormer roof lights.

The above information is due chiefly to the courtesy of the Rev. W. A. Davies, M.A., the present holder of the living, who afforded the writer every possible facility.

## Grim Fight at Maiden Castle

Hundreds of recent visitors to Maiden Castle, the colossal pre-Roman township near Dorchester, have been staring in fascination at thirty male skeletons dug out in the eastern entrance, just as they were hastily buried after a short hand-to-hand tussle between Roman legionaries and the pick of the fighters of the hill fort. Some of the skulls are dented by cuts from the short legionary sword. General Vespasian's left wing of the Roman invasion advancing south-west in A.D. 43 met little resistance in Sussex, Berks, or Hants, but in Dorset the British garrison put up a spirited show. It was soon over : the guard at the gate were killed to a man, and the rest threw in their hand :- " there was a grim fight in the narrow entrance ways," as Tacitus relates of another such struggle.

# Varnish Film for Geologists

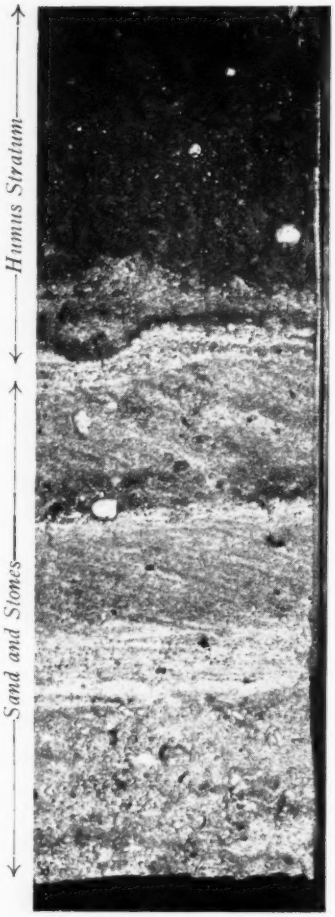
**By Dr. A. Stäger**

*A description of an interesting development of the varnish film technique for obtaining accurate geological sections*

A SHORT while ago considerable Press comment was made about a prehistoric Bass which had been extracted from the sand strata of the East Prussian coast near Palmnicken, in the area where amber occurs. The finding of this skeleton may be important, but the discoverer, Dr. Voigt of Halle, Germany, writes to say that more important discoveries have been made without being noticed by the Press. More interesting that the skeleton of the Bass itself is the new method of extracting it with a varnish film, which the discoverer has developed successfully and adapted for extracting other relics from the ground.

When an excavation is made, instead of taking large and heavy samples of its walls, Dr. Voigt sprays a varnish with a spray gun against the walls. The varnish contains three parts of acetone and one part of zapon lac. This varnish enters the interstices between the particles of the strata and unites them into a film.

In many cases it is sufficient to apply the spray only twice. As soon as the acetone is evaporated the zapon becomes hard. If you tap against the film with your hand and if sand or other particles drop it may be advisable to spray on more varnish in order to produce a thicker film, but if no more particles drop after a further tapping the work can progress. For this a thicker solution will be used which is not diluted. It is called "Sprimoloid-Geiseltallack."* This thick varnish is not sprayed but is applied twice by means of a large soft brush. For large films, exceeding 1 sq. yd., a more resistant layer of the thick varnish must be used and, of course, parts where comparatively large particles or small stones occur must be strengthened by applying more varnish.




*Varnish film representing a vertical section through the brown soil of a forest.*

It is advisable to use plenty of varnish on the edges of the film, thus producing a sort of a frame. This will, of course, make it easier to take off the film from the strata. In warm weather the varnish will dry in a few hours' time, in cool weather perhaps by next morning. For detaching the film from the strata a pocket knife may be used on the edges, but in many cases the film will loosen and sometimes even fall off partly or entirely.

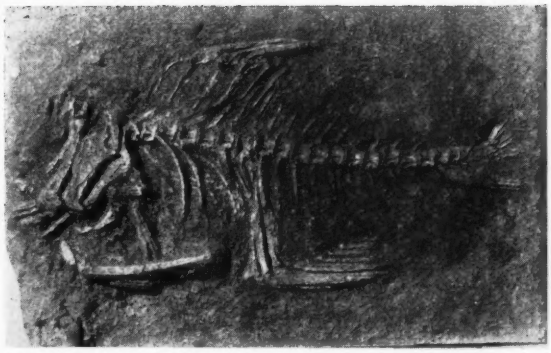
Dr. Voigt in his paper entitled "Die Bedeutung der Lackfilm-methode für die vorgeschichtliche Forschung," published in the *Nachrichtenblatt für Deutsche Vorzeit* (No. 6/7 1935) states that he kept plywood cases on which he fixed the film with drawing pins. If no case is available it is possible to roll up the film like wallpaper or in the way in which turf is rolled up for transportation purposes. In this case it is, however, necessary to flatten the film after transportation, and even to press it in order to avoid its destruction.

The film method is of the highest importance for soil research, mineralogical and geological investigations and, last, but not least, for recovering the remains of plants and animals. Our illustration represents the photograph of a film taken from a perpendicular wall, giving a cross-section through the soil strata.

Everybody who has been engaged in securing soil samples for a museum knows how difficult it is, when using the old method, to recover the samples and transport them to the museum in glass cases, which, of course, require much space. On travels and expeditions through foreign countries it is generally impossible to secure heavy soil samples but by using the new film method it will be possible to obtain thousands of films. In spite of every care, the heavy soil samples

* Obtainable at the Varnish Factory of Messrs. Springer & Möller, Leipzig-Leutzsch.

recovered by the old method can never be kept in the right position as many particles will move and therefore destroy the original structure. On the other hand, it is an outstanding advantage of the film method that every particle, small or large, will be kept exactly in the right position, so that the varnish films give an exact and permanent image of the soil. Also, the natural colours of the soil and its varied strata are preserved by the varnish method as the varnish is transparent and has no colour of its own. It is a special feature of the varnish method that not only will the bones and the hard components of an animal be recovered and be available for observation, but that also the soft parts of a body, such as muscles, skin, etc., can be perfectly preserved in their original position and can easily be examined under the microscope. A thin varnish film can be brought directly under the microscope and be studied by light beams crossing the transparent film. Thicker films can, of course, be examined in reflected light, or they can, by mechanical means, be reduced to a thin, transparent film.



*Skeleton of a Bass extracted from the sand strata of the East Prussian coast near Palmnicken by the Varnish Film method.*

Dr. Voigt has succeeded in observing individual cells and their nuclei in the case of a fossil frog and of many other fossil relics. He has published details in his article entitled, "Die Lackfilmmethode," appearing in *Die Umschau* (Frankfurt a.M.; No. 20, 1936), offering an opening for new possibilities of research.

Although Dr. Voigt has discovered no fabulous monsters in the strata near Palmnicken, it may be said that he has done even more, in developing a new technique that permits the histological study of relics of plants and animals which have been lying in the soil strata for many thousands of years.

## BRITISH ASSOCIATION NEWS

### Autumn Lectures

On Friday, Oct. 22nd, at 5 p.m., at the Royal Institution, Albemarle Street, London, W.1, the Rt. Hon. J. Ramsay Macdonald, P.C., M.P., F.R.S., delivered the Radford Mather Lecture on "Science and the Community." This was the first of a series of lectures under the foundation of Mr. G. Radford Mather, to be given triennially, and to deal with recent advances in Science and their relation to the welfare of the community. The present lecture was given in the Royal Institution by kind permission of the Managers.

Under the terms of the agreement by which the British Science Guild was incorporated into the British Association in 1936, the Norman Lockyer Lecture, delivered annually under the auspices of the Guild, will be continued under those of the Association. The lecture was inaugurated in memory of Sir Norman Lockyer, K.C.B., F.R.S., founder of the Guild and President (1903) of the Association. This year's lecture, the thirteenth of the series, is to be given, as heretofore, in the Goldsmiths' Hall, Foster Lane, London, E.C.2, by kind permission of the Goldsmiths' Company. The lecture will be delivered by Dr. R. E. Mortimer Wheeler at 4 p.m., on Wednesday, November 24th; the subject he has selected is "Origins of Town Life in Britain," and is an illustrated review of recent evidence, much of which has been accumulated by the energetic efforts of Dr. Wheeler and his colleagues.

Applications for tickets should be forwarded to the Secretary, British Association, Burlington House, W.1.

### Indian Science Congress

A large majority of the delegation from the British Association, under its new scheme for scientific co-operation throughout the Empire, will leave England for India on Nov. 26, in the P. and O. liner *Cathay*, arriving at Bombay on Dec. 16th.

They will attend the 25th (Jubilee) meeting of the Indian Science Congress Association in Calcutta from Jan. 3rd to 9th. Lord Rutherford has accepted the invitation of the Indian Association to be president of the Congress, which nearly 40 representatives of other countries will attend, together with about 100 delegates from the British Association with their friends.

A tour through Northern India, with visits to Hyderabad, Agra, Delhi, Dehra Dun, Benares, and other places, has been arranged, and opportunity will be given for excursions from Calcutta on arrival there.

# The March of Knowledge

**Water-Repellent**

A water-repellent which can be applied to coarse or delicate fabrics without impairing their woven appearance, colour, handling or draping qualities and yet is said to be unaffected by repeated washing and dry cleaning has been discovered by Imperial Chemical Industries, Ltd. This new water-repellent is Velan PF, and it was shown for the first time recently at Dorland Hall, W.1. Velan PF is a cream-coloured powder of organic nature, which combines with certain reactive groups, mainly hydroxyl, of the textile fibre, giving new compounds which are highly water-repellent and of great stability. The Velanising process is simple and straightforward. The powder is pasted with warm water and the paste diluted with water, a suitable addition of sodium acetate being made to the bath. The material is then impregnated with the Velan PF solution or suspension, for example, by means of a padding machine, it is squeezed or hydro-extracted, dried and heated. The drying is preferably carried out rapidly and in a current of warm air; the subsequent heating treatment being conducted for a few minutes at 100° to 150° C., when the chemical action between the textile fibre and Velan takes place. Finally, the material is washed in an alkaline detergent bath and dried.

**Anti-Shock**

A watchmaker of Neuveville (Canton Berne) has invented a shock absorber which protects the balance-wheel from injury. Some watches fitted with the shock absorber were dropped from an aeroplane several hundred feet above the Granges aerodrome, and all, even one which fell on a road, were afterwards found to be in perfect order.

**Photo-Electric Colorimeter**

One of the most interesting developments in the measuring instrument field is the photo-electric colorimeter, a new and improved form of which is marketed by The General Electric Co., Ltd. Briefly, it comprises a lamp and two similar glass containers for holding the liquids, together with a pair of matched photo-cells to receive the light through the containers. There are two methods of using the instrument—by comparison or by deflection. In the first method the absorption of one of the liquids is known, and the relative absorption (and so the concentration, etc.) of the other is determined from readings on a calibrated galvanometer. The deflection method is employed with highly coloured or dull solutions, which give deflections over ten divisions, as it possesses the advantage of enabling quick work to be carried out and also has low sensitivity to disturbance. Besides comparisons and measurements of the concentration of coloured solutions, a component in coloured solutions can be determined, for example, the amount of iron in solutions of organic pigments such as wine.

**Roman Chair**

The excavations at Colliton Park, Dorchester, have brought to light the leg of a Roman chair, made of Kimmeridge shale. At the western end of the Roman house was found a heated sitting-room with a tessellated pavement, in which part of the stone work supporting the floor had subsided. This was due to the fact that the filling of an earlier rubbish pit over which the room had been built was less compact than the solid chalk. It was obvious that the pit, which proved to be very deep, must be cleared out, and deep in the filling the leg of the Roman chair was discovered. It is richly carved with the head of an open-mouthed animal, the foot terminating with a lion's claws, and is almost perfectly preserved.

**Black Light**

The popularity of "black light" effects in stage, cabaret and exhibition production has led to the marketing of a handy "black lamp" working off the ordinary electric light circuit. "Black light" contains a large proportion of ultra-violet rays, which, when they impinge upon specially prepared surfaces, cause these to luminesce; the lamp consists of a mercury vapour circuit enclosed in dark glass designed to screen out all visible light and to pass only the invisible. The luminescent "black light" paints tone in with normal colour-schemes under white light; thus, by switching over from white light to black an entire scene can be changed instantaneously.

**Vitamin From Rice**

Rice, or rather that part of it known as 'polishings', is the source of a vitamin product which is attracting great attention at the London Medical Exhibition, now being held at the Royal Horticultural Hall, S.W.1. Rice polishings are the external layers of the rice grain, usually removed by milling or "polishing" in preparing the cereal for the market. Unfortunately, in the process much of the goodness of the rice is lost, for the polishings contain a high proportion of Vitamin B1, of vital importance in nutrition. Research has now made it possible to recover this valuable constituent from the polishings, and the result is seen in "Ryzamin-B" Rice Polishings Concentrate, a clear, reddish brown, syrupy preparation which is being exhibited by a famous firm of manufacturing chemists.

## New Fossils from the South Coast

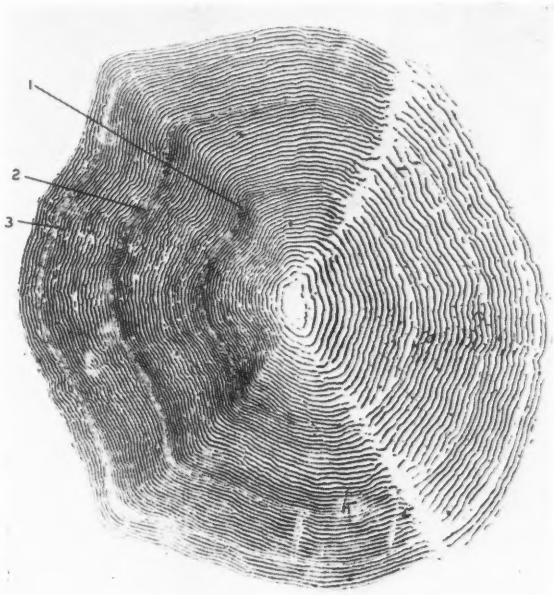
A great series of teeth and other remains of fossil fishes were found last year in the Lower Bracklesham Beds of Southampton. The teeth represent 50-60 species of sharks, rays, and other cartilaginous fishes, and the remains of snakes, snapping turtles, and crocodiles. Eocene fossil fishes have seldom been found in such numbers, and this series comprises, writes Mr. E. M. Venables in the current Proceedings of the Littlehampton N.S. and A. Society, " at least two species not previously recorded from Britain " : *Ostracion meretrix*, an ancestral form of the modern copper fish, and *Ginglimostoma*, a highly specialised form of shark with foliated and plicated teeth. Neither of these has previously been found nearer than Belgium.

In the London Clay of Bognor Regis has been located a horizon containing large numbers of fossilised fruits and seeds in association with fish teeth, many species being new to science and not included in a similar collection from the London Clay of Sheppey made many years ago. Some 30 species of fossil fishes were found, including *Isistius trituratus*, of the same order as the modern piked dog-fish, and now recorded for the first time for Britain ; since its discovery at Bognor it has been found also in Sheppey. With the fishes were found the fossilised bones of several species of birds—another analogy with Sheppey. The only fossil lizard and the only fossil beetle (preserved in iron pyrites) from the London Clay were recorded. The fossils listed from Bognor now represent over 320 species. After rough tides the beach at Bracklesham Bay was strewn with myriads of fossil shells, and several thousand specimens collected included many new records for Britain.

## Scales Show the Age of Fish

There are several ways of telling the age and growth-rate of fish, but the simplest and most accurate method is by microscopic examination of their scales, according to Dr. John Van Oosten of the U.S. Bureau of Fisheries. Since the number of scales on a fish does not increase as the body becomes larger, the size of the individual scales increases along with that of the body and this scale-growth is proportionate to the body-growth. Like the trunk of a tree, the scales of many fish show growth areas that are wide or narrow, depending upon the growth during the growing season. The illustration shows the typical scale structure of the Great Lakes Herring. This particular fish was about 10 inches long and the scale is magnified about 16 times. The roughly triangular area (on the right side of the photograph), with the circular lines relatively widely spaced, is that part of the scale that is exposed and visible, the balance of the surface being covered by adjacent scales.

The age and growth is best read from the unexposed




*Scale of the Great Lakes Herring*

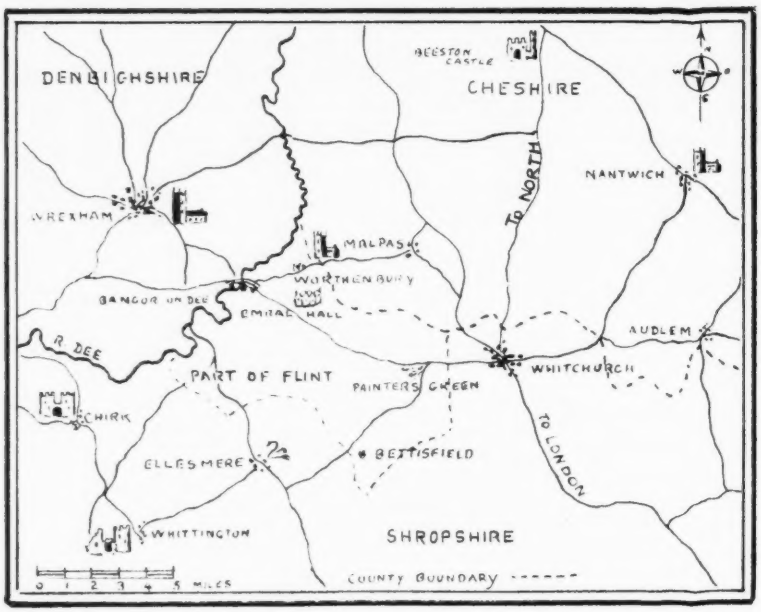
portion of the scale with the finer, roughly circular lines. These circular markings are lines of growth and continue to form as long as the fish grows. During the rapid growth in spring and summer, these lines are more or less complete and continuous around the scale, and they are distinct. As the growth retards in autumn and winter, these lines no longer form completely around the scale, nor are they distinctly spaced. This area of incomplete, broken lines is called the " annulus " or " winter mark " (see 1, 2, and 3) and is easily discernible. By counting these marks the age is determined in terms of winters passed, and the number of summers is shown by the broad growth areas. The scale in the photo shows that the fish survived three winters and passed into its fourth summer, since it was caught in July. The age of Great Lakes Sturgeon as old as 63 years has been determined in this way. By comparing the diameter within each winter-mark to the diameter of the entire scale, the size or length of the fish at any period of its age may be accurately computed. The exact age and growth data, determined by this method, are of value to commercial fishermen, zoologists, and official game commissions.

# Where was Borrow's Dingle?

By Gwendolyn M. L. Thomas.

*For the many who delight in studying the topographical associations of literature and the literary associations of places, here is a promising theory concerning the site of the glade where Lavengro camped and fought the "Flaming Tinman."*

WHEN reading *Lavengro* and the *Romany Rye* many people must have wondered where the dingle was situated which is the background of both stories. It is usually supposed to be "Mumper's Dingle" near Willenhall in the lock-making district outside Wolverhampton. For myself, I never believed it. Knapp, Borrow's biographer, is only luke-warm over the identification and not without reason, for Willenhall has been a manufacturing village since the days of Queen Elizabeth and it is hard to imagine a quiet dingle, tall trees, field paths, and hawthorn, where even early travellers record treeless desolation. As a matter of fact evidence for this Midland site is very badly supported, the word "Mumper" being the chief clue, a lane known as "Mumper's Lane" having existed outside Willenhall in the direction of Essington.




*Sketch map of the Welsh Marches around Painter's Green, the probable site of the Dingle.*

The careful reader studying the question will find, however, that there are really two different dingles in the famous tales, one at some distance from the other. It is possible therefore that some old haunt of the Romanies near Willenhall struck Borrow as having a picaresque name and that he later transferred this (for he loved to mislead his readers) to another place. It must always be remembered too that in Lavengro he is an artist recounting adventures which had taken place twenty years earlier and that he made Time and Space submit to his visionary recollections and provide him with an enveloping atmosphere of mystery and delight. Since the proximity of the Severn is mentioned in the autobiographic vision of Lavengro the first dingle is generally supposed to have been situated in Shropshire. A clue to the direction in which the wanderer's fancy was leading him when he drew near it is found in his spoken cogitation with the frightened tinker with whom he speculates upon the chances of a quiet life for one of his calibre in Chester, decides against proceeding there, and buys the little cart and tinkering outfit instead. The country through which he then passes, walking at the head of his little pony, is described as beautiful, interesting, and solitary. A great heath with pine woods is near by and the dingle when he reaches it is a place of hazel and holly: but there is nothing else to tell us where this first abode was situated, save that travelling north-west from it one could reach the Welsh border in two days and a night.

The story goes on to tell of a second dingle, and it is about this dell, called "Mumper's Dingle" and usually identified with Willenhall, that the whole interest of the adventure is centred, since it was the scene of the fight with Flaming Tinman, a haunt of the Petulengros and the place where the gentleman blacksmith set up his forge and made love in so leisurely a fashion to Isopel Berners who took up her abode on the opposite side of the wood. Without authentic information to fall back upon it is not easy to identify the whereabouts of this dell. One might guess it to be near Cheshire since Cheshire smiths

and milkmaids are referred to. Also it must certainly be near Wales, not only on account of the first dingle's site in Shropshire, but because Borrow had Wales so much in his thoughts at that epoch that a poem called " Mountain Snow " is written in pencil on the back of one of the manuscript sheets of " Lavengro."

As a matter of fact it is on the border, and anyone driving north from London to Liverpool on the old Chester road by turning towards Wales after passing through the little market town of Whitchurch, may camp in it to-day and still find it quiet and beautiful. Also there is good evidence for connecting the spot with Borrow since he was a favourite visitor at the old mansion of Emral, the seat of the Puleston family, close by. The Pulestons are long since gone, but the tradition handed on with the estate was that just where the family property ended (on the border of Wales where Shropshire and Cheshire also meet), in a pretty corner at the roadside, the wandering author had once in reality pitched his camp. Since Emral has been dismantled and this year razed to the ground, this unrecorded tradition should be valuable. I heard it when one summer day, five years ago, I had an errand to the ancient mansion. Having been shown the treasures of the old saloon and the dining-room often sketched by Randolph Caldecott, I stood at the door talking to the last châtelaine. She had been speaking of Victorian books and pictures and suddenly a thought seemed to strike her and she said :

" Do you know we have quite a famous place near by ? —Borrow's Dingle." " No," I replied, " could I see it ? " " Oh easily," she answered, " by driving towards Whitchurch on the main road. It is called Painter's Green and lies upon the roadside three miles further on."

So I drove off down the drive and through the beautiful old gates and soon gained the high-road. As I went, I thought over the story and came to the conclusion that the tradition was probably correct. One can follow the journey of the erratic scholar easily.

When Peter Williams, the Welsh preacher, and his wife Ruth discovered him lying ill and deserted after Mrs. Hearne's half-eaten cake had nearly done its deadly business, they set out at once for the Welsh border carrying the stranger with them and, having travelled due west for a day and a night, stayed in a valley below a farmhouse owned by Methodists. Resuming their journey they came in one day to a brook that formed the border between England and Wales. Here they met Jasper Petulengro galloping through the water and as Lavengro did not want to go into Wales except as a conquering hero and Jasper thought him in danger of gipsy vengeance, the party broke up and Jasper took the still rather sick man and his pony cart yet another day's ride northward. A friendly fight diversified the journey and then they parted at a cross-roads ; but not before Petulengro had advised his friend to lie low in a favourite camping place of his own until Mrs. Hearne's drastic vengeance was forgotten. This was the famous dingle.

That it was not far from the main road to Liverpool (which passes through Whitchurch) we know, not only from clues in the story, but because some fifteen years later, Borrow makes Petulengro remind the amateur gipsy (in *The Zincali*) of the noble horse he bought while he was living in the dingle near the great road. Lavengro

*Wrexham as it was in Borrow's day, showing the Whitchurch road by which he would have approached the Horse Fair. From a painting by J. Caldecott, brother of Randolph.*

took his friend's advice, turned right at the crossing, travelled on some ten miles and found the place—a deep hollow in the midst of shelving fields—five miles from a small market-town, just as his gipsy helper told him he would. There he settled, fought "the Flaming Tinman" (with the assistance of Isopel) and never left the spot, except for short journeys, till he lost his unacknowledged sweetheart.

### An Unchanged Scene

On the day that I was given the unexpected information treasured at Emral I soon struck the quiet old road between Wrexham and Whitchurch where gipsy horse-drovers are still to be met, and was just about to cross the border out of Wales, in fact, was looking for the brook that represents it, when I saw a pretty corner where there was a quaint old cottage and a side lane. I felt certain it was Painter's Green and drew up close to a broad grass-band beside the road—a miniature green with a raised bank running steeply backwards downhill into a little wood. It was a June morning with birds singing and the foot-track leading into the quiet hidden depths, full of dog-rose with brushwood and brambles beyond, looked very alluring. Leaving my car, I crossed the bank and went down into a hollow where the sun was shining through the leafy roof, and, after passing briars and brambles, got to a clearing under a green canopy of tall trees. As I got to the bottom, a cuckoo called out suddenly from the far edge of the rough wood beyond. "Jasper's cuckoo," I said to myself, and that moment came to a small pit of water with a large flat stone lying near it and green grass all around. There was wood ash on the ground around the stone, the pit was full of clear water and an old kettle lay close by. In fact the whole atmosphere of the place was identical with that of Borrow's story. After sitting awhile beside the water listening to the sweet singing of the birds whose notes were the only sounds in the quiet of the summer day, I investigated the rest of the little wood and found, that just as in the story, there was a narrow cart track leading into it as well as the footpath, a track evidently still used by gipsy campers. The wide fields around were there, too, but hedged-off now and no longer growing rye. The effect of the quietness, the singing birds and the sun's warmth was dreamlike and I could almost hear the creaking of the wheels of Lavengro's cart returning from a tinkering expedition in Cheshire lanes, whilst the kettle lying near the pool made one imagine it was waiting for Isopel to fill and that she would presently call out to her companion who would be at his forge: "Shall I make the tea?"

Sitting there I wondered where they had put the chaise that got overturned during the thunderstorm and whether, if one came on Sunday, one would hear distant bells ringing across the fields and saying: "Come to church, come to church," as clearly as it was possible for church bells to say. I wondered, too, if a wonderful 16th-century inn in the near neighbourhood was the one where the noble horse was stabled who neighed when the scholar-gipsy approached his stall and upon which he rode away to further adventure.

I thought I would ask the Lady of Emral these things the next time I passed that way, but alas, neither I nor the world will ever know now, for, before that day came, she had died, and the next thing I heard about the old hall was that housebreakers were carrying away the beautiful fireplaces, doors and panellings that we had looked upon together. It seems certain that the site is the correct one, for Whitchurch would suit the story as the town close by, whilst Wrexham, noted for its wonderful horse sales, would be the place where the great horse-fair was held to which the whole company of gipsies repaired, setting out very early in the morning. Only the wide plain around appears to be missing. And this may have been skilfully transferred by Borrow from the other side of Whitchurch, where Prees Heath still spreads its hundreds of acres of rolling heather and welcomes wandering wheels. I have since thought that the church surrounded by beech trees of vivid green, to which the gipsy party walked three miles and a half on field paths, must be that of Worthenbury which can be little more than that distance across country, and which is set round with beech trees—an unusual thing in this district.

The curious incursion of Wales into Cheshire and Shropshire at this point on the border (as shown in the map) makes Borrow's reference to Lavengro's blacksmith's work as better worth while "than running after milkmaids in Cheshire," a quite sensible remark, since a little stroll across the fields brings the pedestrian into that county. Whilst the remembrance of the blue hills of Denbighshire standing out beautifully clear from a hill-top on the road not far from the dell and telling of those bolder fastnesses beyond which were so dear to his imagination, may have had something to do with his writing verses on Mountain Snow as a relaxation from the longer task of telling his adventures.

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Dr. C. C. Paterson, O.B.E., M.I.E.E., F.Inst.P., who delivered the Guthrie Lecture of the Physical Society at the Imperial College, South Kensington, on Oct. 22nd, chose as his subject "The Appraisement of Lighting." Dr. Guthrie is Director of the G.E.C. Research Laboratories at Wembley and is a recognised authority on illumination. He has held many key positions in the electrical world and was responsible for establishing the Electrotechnics and Photometry Divisions of the National Physical Laboratory.

# Art in Nature Photography

**By a Special Correspondent.**

*A retrospective review of the nature photographs at the Royal Photographic Society's Annual Exhibition, which closed on October 6th, combined with a review of "The Year's Photography," published by the Society at ten shillings and sixpence.*

NATURE photography is to some extent the Cinderella of the camera art family, and it is, therefore, especially pleasing to record that *The Year's Photography*, a digest of the Royal Photographic Society's Annual Exhibition, gives to nature pictures their properly prominent position.

True, they were on the first floor at the Exhibition, but on the occasion of my visit there were far more interested visitors in that room than viewing the more "artistic" exhibits on the ground floor. I do not wish to underate the excellence of the posed pictures, landscapes and architectural views, but I feel bound to say that many of these exhibit far less skill in composition than do the nature shots. The latter, moreover, are mostly the result of hours of waiting, at a site to select which a great deal of experience is required. John Markham's picture of a field vole, for instance, must have been the outcome of much patient watching.

The point which struck me most forcibly was the wonderful way in which fast panchromatic plates are improving colour-rendering. Ian Thomson's "Red-legged Partridge" (Plate XXXVII in the book) is as colourful as monochrome could ever be, and so is J. E. Ruxton's "Black-throated Divers." The intrepid Hugh Wagstaff shows us a cock buzzard arriving at its nest, and not even looking at the camera.

H. S. Thompson's "Gannet in Flight" (Plate XLV) is another kettle of fish. Anyone can find a gannet, and any shutter working to 1/500 sec. will "stop" it. But note how cunningly the bird is taken with wings raised and pointing backwards, and how the blank space in front of the bird combines with this to produce a dynamic effect of flight!

Turning aside from birds, who would have thought of taking a picture of "Raindrops on Lupin Leaves"? Laura Gilpin did, and made a first-class artistic study. That, you will object, is not nature photography; it is a poor attempt at photographic surrealism. This picture might well be described as a missing link. It is an example of how nature can go one better than the brightest brain in the studio in providing a photographic tableau. E. J. Bedford realised this, too, when he took his picture, "Ragwort." He did not want a picture of ragwort showing stamens, sepals, and so on; he wanted the spirit of ragwort, and by those few stalks of tall grass and the suggestion in the left-hand top corner of a sun-baked wall, he registered on paper the glorious sunny freshness which is the whole attraction of ragwort. Lt.-Col. F. D. S. Fayrer, with his "Pampas Grass," scored a miss. It is a picture of pampas grass all right, but the austerity of the clump is spoilt by the untidy background of poplars. R. J. Smith, with his "Head of a Hump-Back Whale" has, intentionally or not, produced a picture with a distinct "atmosphere"

*"Otter," by Oliver G. Pike from* The Year's Photography.

by picturing the animal looking so much like the bottom of a German cruiser, scuppered and refloated upside-down, that the effect of immensity, never easy to obtain in water, is fully expressed.

The palm, however, for character presentation, must go to Oliver Pike for his "Otter." Never before have I seen an otter captured in such an "otterish" pose. The curve of the body followed by the curve of the heavy tail, with the muddy water full of broken dried grass, gives an effect vastly superior to any produced by pictures of the animal sitting up nicely on dry land.

In case the above may seem too harsh to those who delight in picturing animals and flowers as they really are, let me praise without reserve H. J. Howard's "Night Flowering Cactus", anatomical, yet fixing the beauty of the bloom pleasantly and quite without harshness.

*The Year's Photography* contains in all sixty-eight plates and a number of interesting articles, and is clearly and cleanly printed in photogravure.

# BOOK REVIEWS

## Mountains of the Moon*

RATHER more than eighteen centuries ago Ptolemy described the Mountains of the Moon as the source from which the lakes of the Nile receive winter snow. We need not worry over the geographical problem raised by his words, but cheerfully agree with Mr. Synge, whose book is the subject of this article: "If we really want to allot to any one range the proud title, it seems that Ruwenzori is the most suitable." There are few places in the world which make as strong an appeal to the imagination as the groups of noble mountains rising to heights of 17,000 ft. and more above sea-level on the equatorial tableland of Africa. Of these the Mountains of the Moon are perhaps the most impressive and the most interesting. Much has been written on these mountain groups and on their flora and fauna: Mr. Synge mentions some of the earlier explorers, but makes no reference to the admirable and pioneer work of that indefatigable geologist, the late Professor Gregory. The author's purpose was to tell the story of his own journeys; taking us with him to enjoy the amazing plants, sharing with us their beauty and strangeness; introducing us to the African peoples whom he met, and discussing with us many problems of imperial importance.

He has carried out this purpose with conspicuous success; the book is simply and delightfully written, illustrated by numerous photographs taken by himself and his companions, and several drawings and paintings by Mr. Stuart Somerville, who achieved excellent results in very difficult circumstances. Plate 27, a picture full of artistic feeling, is a good example of Mr. Somerville's style; it is a view of one of the lakes in the Nyamgasani Valley, which gives a vivid impression of a beautiful and haunting scene in a strange land.

The author, while still an undergraduate at Cambridge, had the good fortune to be a member of a botanical expedition to the tropical forests of Borneo, and this whetted his appetite for exploration and collecting in other parts of the world. A further opportunity arose when the Trustees of the British Museum organised an expedition to East Africa "for the purpose of studying the flora and fauna of the equatorial mountains in relation to their peculiar environment." Financial help was provided by the Percy Slade Trustees, the Godman Fund, the Uganda Government, and the Royal Geographical Society. The members of the expedition were: Dr. F. W. Edwards, a member of the Entomological Department of the British Museum, Dr. George Taylor of the Museum Botanical Department, Mr. Patrick Synge, Mr. John Ford, Mr. Stuart Somerville, Dr. David Buxton, and Mr. George Hancock, to whom the book is dedicated in recognition of the invaluable part he took in fathering the expedition and in placing his house at Kampala at the service of the travellers.

*The five Spires.*
(Lobelia gibberoa at 7,000ft. on Ruwenzori).

The flora of the equatorial mountains is exceptionally stimulating to botanists interested in the wanderings and evolution of plants. "It is a curious fact that many of the genera . . . and even a few of the actual species are similar to those found in England." High up on Ruwenzori "we found a white sanicle similar to that found in English woods, while on Elgon there was a little violet with mauve flowers, though without any scent." The cosmopolitan bracken gives a homely touch to the vegetation on the lower slopes of the mountains. Another botanical problem is suggested by the fact that the widely separated mountain islands possess a very similar plant population, differing considerably from that on the intervening tableau. As in the northern hemisphere, so in regions south of the equator there was a glacial period, though on a much smaller scale, and this helps us to explain the present isolation of the mountain flora which was driven to higher levels as the ice retreated. In addition to these general botanical problems, there is another more puzzling aspect of the vegetation peculiar to the Mountains of the Moon and their companions: this is the phenomenon known as gigantism, the occurrence of tree-like species

* *Mountains of the Moon.* An Expedition to the Equatorial Mountains of East Africa. By PATRICK M. SYNGE, with 93 illustrations from photographs and drawings by STUART SOMERVILLE. (Lindsay Drummond. 15s.)

of plants, which in other parts of the world are represented only by comparatively small, herbaceous forms.

The two most striking examples are afforded by species of Lobelia and Senecio. Before saying more about these herbaceous plants that have become trees, let us follow the changes in vegetation from the lower ridges to the snow-covered peaks of Ruwenzori.

A few years ago it was my good fortune to wander for a few hours over the lower slopes of Mount Kenya: there, with the bracken, were a few tree ferns and other tropical plants, and an occasional arborescent Lobelia—a strange mixture which made one long to penetrate beyond the foothills. For many of us:

" The heart goes where no footsteps may
Into the promised land."

Now, it is possible to see these things with the eyes of Mr. Synge. Above the bracken there is an abrupt change to the forest which covers all the ridges above 6,500 ft., stretching great tongues down the valleys beside the rivers. Tree ferns, and wild bananas " with hard seeds like large rounded beans add dignity and distinction to the undergrowth." The next zone is a dense forest of bamboos, often fifty feet tall, their graceful, feathery plumes " the very acme of lightness." Gradually the giant bamboos are replaced by smaller ones and then follows a zone of tree heaths similar to those on the hills above Teneriffe and elsewhere in the Canary Islands.

*An Old Man of the Mountains.*
(A veteran Senecio in the crater of Mt. Elgon).

It was at this stage in the ascent that stiff spikes of Lobelia barred the path, " like figures with upright lances," plants which seemed to belong to a prehistoric age, fit companions for the monstrous reptiles of a long past geological period. Mr. Synge describes several species of the tree-like lobelias, *Lobelia Bequaertii* with rosettes several feet across, of several hundred closely-packed leaves, and a stiff green "obelisk-like spike, monstrous and bizarre"; *Lobelia Wollastonii*, named after A. F. B. Wollaston of tragic memory, producing pale blue silvery spikes often 15 ft. in height. Here, too, was a St. John's Wort, *Hypericum Bequaertii* of the size of a small tree.

At an altitude of over 14,000 ft. the vegetation became very sparse, consisting chiefly of a black, rather dried-up lichen, with occasional small bushes of a woolly " everlasting." As high as 14,600 ft. a very few small Senecios were found at the foot of the glacier. It is no wonder that Ruwenzori seemed to the visitors from another world to have a definite personality, a mountain which " really had something to say to the traveller."

Unlike Ruwenzori, Mt. Elgon is an extinct volcanic crater, surrounded by an expanse of moorland similar to the moors of Dartmoor or the highlands of Scotland. It was on this mountain that the expedition encountered the first Giant Senecio; " a veritable tree over 20 ft. high, branched, gaunt, and with a certain pathetic, bizarre and indescribable look of unreality . . . a trunk twisted and contorted, surmounted by mops of foliage like great lax cabbages. The leaves are very large, sometimes 3 ft. in length, and of a rather fierce shade of metallic green." From the centre of the cabbage crown there emerges a great spike 3-4 ft. in height and repeatedly branched.

The arborescent Senecios, Lobelias and other genera, which give a special character to the vegetation of the African mountains, remind us of the Dinosaurs and other extinct animals of unusual size; they also recall the Lepidodendra, Calamites, and other trees in the forests of the Coal Age, whose nearest relatives in the present world are small herbaceous plants. Gigantism, in the past, is associated with lack of persistence; we think

of the overgrown members of both the animal and the plant worlds as examples of what may be called nature's unsuccessful experiments. What is the explanation of the gigantism, which is so striking a peculiarity of some of the mountain plants in Africa? To this question no satisfactory answer has been given.

On the return journey from the mountain islands, Mr. Synge tells us of the blue water lilies of Lake Kioga, and *Nymphæa Lotus*, probably the Egyptian lotus with which we are familiar in the carvings and frescoes of ancient Egypt. He also gives an excellent and well-illustrated account of another Egyptian emblem, the papyrus, which no longer grows in the valley of the Nile farther north.

In an Appendix Mr. Synge adds an encouraging account of experiments made in his Surrey garden in the cultivation of Senecios, Lobelias, and other East African plants. It is impossible in a single article to do justice to the book under review. Attention has been concentrated on the botanical work of the expedition, because that was the author's main objective and occupied more time than many people unfamiliar with scientific plant collecting realise. But Mr. Synge made full use of opportunities of getting to know the natives, a term he dislikes and suggests in its place, "African": he pays a tribute to the intelligence of the boys and takes an optimistic view of their potentialities. His chapters on "Town Life in Uganda," "Yesterday in Uganda," "To-day and To-morrow in Uganda," show that the author has sound views on imperial responsibility, an appreciation of the receptivity of the younger generation and a realisation of the importance of making the best possible provision for the encouragement of higher education. After close contact with three boys from Makerere College for a fortnight on Kenya Mountain and contact with several more during Mr. Hancock's work and classes, he says: "The feeling was borne in on me very strongly that the mental difference (between the African and the European) was extremely slight, in fact almost negligible, while the inferiority was in no way apparent." Mr. Synge's book enables us to visualise and enjoy the unique plant-world of the Mountains of the Moon; it also reminds us that there are human inhabitants in East Africa worthy of the best that this country can give them.

A. C. SEWARD.

## Books Received

*The Land of The Gurkhas.* By MAJOR W. BROOK NORTHEY. (Heffer, 10s. 6d.)

*Wonders of the Great Barrier Reef.* By T. C. ROUGHLEY. (Angus & Robertson, 15s.)

*My Jungle Trails.* By A. HYATT VERRILL. (Harrap, 12s. 6d.)

*Coming into Being Among the Australian Aborigines.* By M. F. ASHLEY-MONTAGU. (Routledge, 21s.)

*Towards Angkor.* By H. G. QUARITCH WALES. (Harrap, 12s. 6d.)

*Explorers' Club Tales.* (Harrap, 10s. 6d.)

*French Indo-China.* By VIRGINIA THOMPSON. (Allen & Unwin, 21s.)

*In Breckland Wilds.* By W. G. CLARKE. Revised edition by R. RAINBIRD CLARKE. (Heffer, 12s. 6d.)

*Earth-Lore.* By S. J. SHAND. (Murby, 3s. 6d.)

*Some Cases of Prediction.* By DAME EDITH LYTTELTON. (Bell, 2s. 6d.)

*A Scheme of Inorganic Qualitative Analysis.* By F. M. STODDART. (Heinemann, 1s. 6d.)

*Perspectives in Biochemistry.* Thirty-one essays, edited by J. NEEDHAM and D. E. GREEN. (Cambridge Univ. Press, 15s.)

*The Fine Structure of Matter.* (Part I.) By C. H. DOUGLAS CLARK. (Chapman & Hall, 15s.)

*The Advancing Front of Science.* By GEORGE W. GRAY. (McGraw-Hill, 12s. 6d.)

*Man in a Chemical World.* By A. CRESSY MORRISON. (Scribners, 12s. 6d.)

*A Short History of Chemistry.* By J. R. PARTINGTON. (Macmillan, 7s. 6d.)

*Cosmological Theory.* By G. C. MCVITTIE. (Methuen, 2s. 6d.)

*The Romance of Medicine.* By JOHN HAYWARD. (Routledge, 6s.)

*Communication has been Established.* By ASTLEY J. H. GOODWIN. (Methuen, 10s. 6d.)

*Charles Darwin.* By GEOFFREY WEST. (Routledge, 15s.)

*My Fifty Years of Sport.* By C. VAN DER BYL. (A. H. Stockwell, 5s. 6d.)

*Free Will or Determinism.* By M. DAVIDSON. (Watts, 10s. 6d.)

*French Painting and the Nineteenth Century.* By JAMES LAVER (Batsford, 21s.)

*Differential Calculus.* By S. MITRA and G. K. DUTT. (Heffer, 10s.)

*Report on Puss Moth Accidents.* By the Accidents Investigation Sub-Committee of the Aeronautical Research Committee. (H.M. Stationery Office, 30s.)

*The Young Men are Coming.* By M. P. SHIEL. (Allen & Unwin, 8s. 6d.)

*The World of Atoms.* By A. HAAS. (Chapman & Hall, 10s. 6d.)

*The Handmaiden of the Sciences.* By E. T. BELL. (Bailliere, Tindall & Cox, 9s.)

## Some Forthcoming Books

*African Hunter.* By BROR VON BLIXEN-FINECKE. (Cassell, 12s. 6d.)

*The Forests of West Africa and the Sahara.* By E. P. STEBBING. (Chambers, 15s.)

*Camera Around the World.* Edited by HEYWORTH CAMPBELL. (Chapman & Hall, 12s. 6d.)

*Studies of British Birds.* By "FISH-HAWK." (Duckworth, 15s.)

*The Black Musketeers.* By A. J. MARSHALL. (Heinemann, 15s.)

*Everest: The Unfinished Adventure.* By HUGH RUTTLEDGE. (Hodder & Stoughton, 25s.)

*An Introduction to Weather and Climate.* By G. T. TREWARTHA. (McGraw-Hill, 18s.)

*Modern Life Chemistry* By F. O. KRUH, R. H. CARLETON, and F. F. CARPENTER. (Lippincott, 8s. 6d.)

*Himalayan Assault.* FRENCH HIMALAYAN EXPEDITION. (Methuen, 18s.)

*The Heart of a Continent.* By SIR F. YOUNGHUSBAND. (Murray, 9s.)

*Psychology Down the Ages.* By PROF. C. SPEARMAN. (Macmillan, 30s.)

*Big-Game Hunting and Adventure, 1897-1936.* By MARCUS DALY. (Murray, 10s. 6d.)

*Out of Africa.* By KAREN BLIXEN. (Putnam, 10s. 6d.)

*East Goes West.* By YOUNGHILL KANG. (Scribners, 10s. 6d.)

## Sea Yarns Vindicated.

*Giant Fishes, Whales and Dolphins.* By J. R. Norman and F. C. Fraser. Illustrated by Lt.-Col. W. P. C. Tenison. (Putnam, 15*s.*)

Those at sea, and even mere visitors to the seaside, will now have no excuse for remaining in ignorance of the monsters of which they may catch a glimpse. The thresher shark paraded by longshoremen, the basking shark described in the daily Press, the record tunny caught on rod and line off the Yorkshire coast, can now be recognised and their measurements and habits discussed. The yarns of seafaring men can now be judged by the stay-at-home upon their merits and, to the surprise of many, will mostly be found to be true. What is more, as usual, the truth is far stranger than the tales of imagination. For what queerer creature could there be than *Regalecus*, the ribbon fish, that looks like the fruit of a nightmare? On only two occasions have they been observed alive, but they are at times washed ashore, when their fragile, watery bodies rapidly perish. The authors, who consider there is but a single, almost world-wide species, state that it may grow to 20 ft. in length, although but a few inches high. They do not allude to the Tring specimens; one of these, from Flamborough Head, is 12 ft. 9 in. in length, the other, from New Zealand, is 14 ft. 4½ in.

The authors discount many of the fearful yarns about sharks. They dispose of two popular fallacies, that the shark must turn on its back before it can seize its prey, and that a shark can bite clean through a man's thigh. Their equipment of teeth is fearful, but they have nothing like the power of jaw for that. But they are quite formidable enough. *Carcharodon*, the great white shark, a swift and fierce brute, may run to 40 ft. in length. The Challenger Expedition dredged up teeth of one of these 5 in. in length, which must have come from a monster nearly 100 feet long. Linnæus believed that it was this species which offered temporary hospitality to Jonah, and it is commonly called the man eater, but the authors think that the fact that these sharks, like many others, feed greedily on corpses, accounts for the human remains sometimes taken from their stomachs. Authorities in Australia have a grim list of eighty attacks by the fierce and insatiable blue shark on human beings, of which about twenty were fatal. Sharks also indulge in eccentricity of form, like the hammerheads, which feed mainly on thornbacks and sting rays. Eccentric in name as well is the wobbegong, which, at least in Fig. 17, has a woe-begone appearance.

Another group enveloped in legend is that of the rays, which includes such queer customers as the sawfish and torpedo, as well as the sting and eagle rays, whose tails do carry venom, and may cause convulsions, extreme agony, and even death. The eagle rays are nearly as formidable as the sting rays, and Dr. Coles, when stung, found the pain more horrible than he had thought it possible man could suffer. Fortunately, injection of potassium permanganate gives instant relief.

The mobular, although nearly as old in appearance as in name, and running over 2,000 lbs., is stated to be graceful in movement with a musical, bell-like note, and apparently affectionate in disposition. These engaging monsters, which feed on "minnows," are closely related to the manta or devil-fish, which may exceed 20 ft. in breadth and run to 3,000 lbs. and over. These too are surprisingly graceful in their movements. When they leap into the air and fall back, the spank of their bellies on the water can be heard for miles. Though feared by pearl-divers, these monsters are not dangerous to man.

Swordfish are big and sporting. One, a black marlin, has been recorded in New Zealand weighing 976 lbs. It has been argued that the swordfish cannot drive its spear into a boat, but in the British Museum there is a piece of stout ship's timber with a sword embedded 22 in. into it. Once when swimming in the Bosphorus I saw a big swordfish clear the water only a hundred yards or so from me. They are common on Levantine menus, and the firm, pinkish meat is excellent.

I could continue for hours quoting this fascinating book, especially the romance, and tragedy, of whales. The largest animal known, the blue whale or Sibbald's rorqual, figured in Discovery in October, may reach 100 feet and the young are 24 ft. in length at birth.

Of the tragedy of the whaling industry we have recently heard much, and of steps taken to preserve threatened kinds. A more enlightened posterity will look back upon those who tolerated the whale trade with the feelings with which we regard those who flourished on the slave trade.

The illustrations are a notable addition to this delightful most useful book.

Malcolm Burr.

## Physical Properties of The Aura.

*The Origin and Properties of the Human Aura.* By Oscar Bagnall. (Kegan Paul, 7*s.* 6*d.*)

In introducing his subject Mr. Bagnall states that it has been supposed for a long time that human beings are surrounded by something which has been called by the mystical name, the aura; a name that has shrouded it in a veil of romance and fantasy almost to its exclusion as a subject for serious scientific research. We are inclined to think that neither romance nor fantasy would furnish an adequate reason for the neglect by serious science of the study of the aura and would be tempted to believe, on that account, that its existence is more subjective than objective.

The author refers to the work of the late Dr. Walter Kilner, X-ray specialist in St. Thomas's Hospital, as a collection of interesting cases dating back to pre-war days. Beyond this brief note there is very little further reference of a character that would impress one with confidence that such a thing as an aura existed. Mr. Bagnall, however, assures us that the haze or aura surrounding the human body is a physical fact and not an illusion of a subjective character. In the chapter dealing with the physical properties, we therefore look somewhat expectantly for proof of the aura. The following statements are quoted therefrom. A haze can be seen surrounding a newly-born baby. The author has seen the aura a few hours after birth. Death is supposed by Mr. Bagnall to destroy the aura, although of this he has no proof.

Mr. Bagnall then supports his physical theory by making the suggestion that the aura is an ultra-violet phenomenon, that is ultra-violet rays rendered visible by the application of a sensitising medium to the eyes. The question then arises as to the material characteristics of such an aura as would be competent to reflect ultra-violet rays. Light whether within or without the visible spectrum is invisible in itself, and affects our vision only when reflected, by enabling us to see the object illuminated.

Mr. Bagnall decides that the aura is not a vapour. It is not, he says, affected by change of temperature nor dispersed by a current of air. Indeed, if we follow the argument to the end, we realise that no decision is reached and absolutely nothing positive placed before the reader. The conclusion seems then to be that under certain conditions an aura is visible, possibly something like the haze which is seen to surround the moon and which is

believed to presage rain. If the aura surrounding the body is physical in character, it is possibly capable of reflecting light rays, whether these be visible or invisible. Actually, according to Mr. Bagnall, the rays are invisible normally, but this is immaterial, for it is not the rays that constitute the aura but the physical counterpart which reflects the rays, and one is tempted to say there " ain't no sich thing." We are not dogmatic on the point, but we do not seem to have derived much assistance from Mr. Bagnall's narrative and his story from beginning to end is not inconsistent with the subjective view of the problem in hand.

## Life in the African Protectorates

*Zulu Journey.* By CAREL BIRKBY. (Frederick Muller, 12*s.* 6*d.*)

This is a cheerful account of a journey through Zululand and the neighbouring countries by an experienced and observant journalist. He has collected a mass of information, much of great interest, and presented it in a bright and attractive style. We are too much inclined to take South Africa and her history for granted, and because we have read Allan Quatermain when boys, to think we know Zulu history. So there is scope enough for a book like this, which tells us something of the conditions of life in the protectorates of Swaziland and Basutoland, and how and why these are so different from Zululand, and Tongaland, and Transkei, and Pondoland, and the tragi-comedy of Griqualand. We read of Chaka as a " homicidal invert with an Œdipus complex," whose horrors were far greater than the mere bloodlust of an insensate savage. The great Black Emperor had at least one streak of sanity, in that he refused to transmit his taint, and had all his children smothered. Very different was that strange white chief of the Zulus, who left sixty children living when he died in 1895, and such a legacy of confusion in the ownership of land that the legislature found it necessary to pass a " John Dunn (Distribution of Lands) Act No. 15 or 1935," legalising the division of 10,000 acres among his children. His grandchildren must run into many hundreds to-day.

We are given an account of the tragic mystery of the *Grosvenor*, wrecked off Port St. Johns, with £3,000,000 in treasure on board, some 150 years ago. The tragedy is that the fate of the white women who were saved was never known. The author suggests a connection there with the " queer clans of pale faced Pondos . . . sad-eyed and strangely aloof," who are a living enigma to this day.

We are given a charming picture of Basutoland, where some 600,000 attractive Basuto are happily administered by a dozen British officers, " an extraordinary example of British ability to rule."

The author had the knack of making friends with the natives he met, and he certainly enjoyed his trip. The photographs are numerous and good.

## Congestion in Turkistan

*Forbidden Journey.* By ELLA K. MAILLART. (Heinemann, 12*s.* 6*d.*)

*Journey to Turkistan.* By SIR ERIC TEICHMAN. (Hodder & Stoughton, 15*s.*)

It is not given to many explorers to be " reported " on their travels, and there is something strange in the idea of that indefatigable globe trotter, Mr. Peter Fleming of *The Times*, tramping across Asia under the eagle eye of a lady representative of the *Petit Parisien*.

It is pleasing to report that Mr. Fleming comes out with flying colours. He is just as we have always imagined him: eternally impatient, disregardful of good advice; steadily cheerful and not too inquisitive. He is reported as swearing at the natives only once, and if at any time he " had words " with his companion, Mlle. Maillart does not record it.

The journey was from Pekin to Kashgar, through the forbidden territory of Sinkiang (Turkistan); the many amusing incidents are amusingly told, and the less amusing incidents, such as arrests, camels dying, films being drowned, are all set forth in good proportion. The most amusing feature of the book is the number of ways in which the travellers' regular question as to the whereabouts of General Ma Chung-Ying, the key-man of modern Turkistan, was answered: "I don't know," was varied by " He is in England buying aeroplanes," " He is in Khotan incognito," " He is in India—in Peking—in Kazakstan." Actually he was in Moscow. A surprising fact that emerges from this book is that blarney is better than a passport in outer Mongolia. Mr. Fleming's passport was not in order for Sinkiang (Mlle. Maillart's, by an accident, was), yet he succeeded in travelling through the entire country and was never arrested for more than four hours. The author puts it down to his charm of manner; Mr. Fleming, no doubt, to the majesty of *The Times*.

This is an extremely interesting and pleasantly written book and the many illustrations are well chosen. The translation is for the most part good, though one or two phrases are obscure. What, for instance, are " sheep-casings for sausages ?"

*Journey to Turkistan* is a very different book, although the journey is through the same type of country, and was undertaken a few months only after that of Mlle. Maillart and Mr. Fleming. The reader realises this early when Sir Eric, camped on the Etsin Gol, writes: " I used to breakfast off tea, fresh milk, and home-made bread baked in our camp oven; lunch off coffee, sheep's liver or kidney and bacon, bread, butter, and honey, a delicious meal; and dinner about 7 p.m., soup, local mutton or game, vegetables and stewed dried fruits. It was life reduced to its simplest terms." When this " simple " life is compared with the *tsamba*, dough strips and buttered tea which were luxuries to the other two wayfarers, the gap which exists between the two expeditions is obvious.

Sir Eric was an official emissary sent out to Urumchi in Sinkiang by the British Embassy in China to see what could be done to foster British trade there. His life was secure: all he had to worry about was whether he could get through to India before winter closed the passes; his journal, therefore, lacks the day-to-day urgency of that of the independent pair. However, it makes interesting reading; it is fully documented and carefully written, and gives a very clear picture of the territory traversed. As the author points out, the Maillart-Fleming expedition kept entirely to the Tungan-controlled territory in the south part of Sinkiang, while Sir Eric's was all the time in Chinese-controlled territory; the two books together, therefore, give a good stereoscopic view of the country. Some interesting points are made about the Chinese language: Khoja Niaj, it appears, is in Chinese Ho-Chia-Ni-Ya-Tju. There are over 100 illustrations to this book; the majority are first class, though insufficiently captioned; twenty-seven, however, feature the motor-trucks, which will seem too many to those numerous readers who prefer to forget that the Ford is now superseding the camel and the yak in Central Asia. Sir Eric records that Turkistan is now flooded with the Amo trucks of Soviet manufacture.

Both these books can be recommended either for politically-inclined readers, for sociologists, or for those merely interested in travel; though it is to be feared that they will leave the impression that the sandy wastes of the Gobi are being cut to

ribbons by motor-truck tyres, and that every desert inn shelters the remains of a broken-down Ford or Amo just as the old caravan routes were strewn with the carcases of camels.

## An Objective View of Culture

*Anthropology : an Introduction to Primitive Culture.* By A. A. GOLDENWEISER. (Harrap, 18*s.*)

Professor Goldenweiser's *Anthropology*, though originally planned as a new edition of an earlier work on cultural anthropology, has transcended its limitations and become a survey of the field covered by the science as a whole. It not only confirms him in his position as one of the foremost exponents of cultural anthropology in the United States, but it places him definitely among those, a dwindling number, who in these days of specialisation are competent to speak with authority and detachment on the more general problems of the science. In " The Ways of Culture," the concluding section of the three into which the contents of this book are divided, the author enters upon an objective and well balanced discussion of such controversial and debatable general topics as the relation of culture and physical environment, the phenomena of cultural distribution and assimilation—an old friend in new form—evolution and progress, and the like.

It is unnecessary to apologise for mentioning the concluding section of the book first. It gives it its distinctive character and it is the most significant of the author's breadth of view. At the same time the introductory section, dealing with " Animals, Man and Culture," is no less noteworthy as a remarkably lucid and fair exposition of the difficult problems of the zoological classification, descent, and racial classification of man, which must be faced and mastered by all, even those whose interests lie in the direction of cultural anthropology. With this the author deals in detail in the second and main section of his book. This analytic study of the various elements in man's culture, both social and material, is enlivened and reinforced by liberal quotation from ethnographical records of individual groups of primitive peoples. It closes with an account of " applied anthropology," as it affects the administration of backward peoples, in which the author is both amusing and acute at the expense of the British administrator—we hope and believe, old style.

## Fundamentals of Nomadism

*The Wandering Spirit : a Study in Human Migration.* By RAGNAR NUMELIN. (Macmillan, 20*s.*)

Dr. Numelin has been engaged for a number of years in collecting evidence bearing upon human migration, both of peoples and of individuals. He has cast his net widely. In time he covers from the Stone Age to the present day ; and in space his sources are world-wide. Yet he appears to have missed some of the more recent investigations among the indigenous inhabitants of America, which would have served his purpose.

Migration is a form of human activity which is fundamental to many, if not to most, of the problems of racial and cultural distribution. The causes to which it is due are both varied and complex. Their investigation requires a breadth of view combined with powers of minute analysis, which are not too common among investigators. The more superficial are apt to fall back upon " instinct " or a somewhat crude geographical determinism. Dr. Numelin is fully alive to the complex character of the factors at which his analysis attempts to arrive ; but it must be admitted that he too is at times inclined to call in instinct without a sufficiently careful indication of exactly what it is that he has in mind in the use of this term. On the other hand in his discussion of the economic factor and his demonstration of the relations which subsist between seasonal nomadism and mode of life as well as subsistence, there is little left to be desired.

As a whole this book will be found a compendium and analysis of facts of no little value to the student, though in some of the sections it will need the assistance of reference to further and later authorities than those quoted by the author.

*Chapters in the History of Owens College and of Manchester University* 1851-1914. By EDWARD FIDDES. (Manchester University Press, 7*s.* 6*d.*)

Although this book will perhaps appeal most strongly to the alumni of Manchester University, students of higher education generally will also find it of interest. The author is an ex-Vice Chancellor and Professor of the University who has had unrivalled experience of its workings and to whom all the relevant information has been available. The book describes the growth of the University from its inception as Owens College, founded by the will of John Owens, its early struggles, and its development to the leading position among provincial universities up to the War. We catch a fascinating glimpse of the hidebound religious and classical prejudices of higher education of the early 19th century, and of the pioneering work that the new college had to perform. Where the older universities had brought education to those members of the Church of England who were aristocratic or rich, Owens College brought it to the middle classes and business men of the industrial north, whatever their persuasion. It grew up with an integral attachment to the great city of Manchester, and later in a close co-operation with adjacent local authorities, that is absent in the relations between Cambridge or Oxford Universities and the towns in which they are situated. Hence its contribution to education was to bring it into closer contact with the ordinary needs of everyday commercial life.

A criticism from the point of view of the general reader is that there are too many short biographical sketches and unfamiliar names which blur what should be—for a short history—strong outlines of general development. On the other hand the book is a monument to all the greater servants and benefactors. We hope that some day Professor Fiddes will find time to continue the story in more recent years.

*A Hundred Years of Chemistry.* By ALEXANDER FINDLAY. (Duckworth, 15*s.*)

This book opens with a short survey of the work of chemists during the late 18th and early 19th centuries, in order to pave the way for an account—in detail—of the progress which has been made from 1835 onwards. It is shown that simple investigations into the nature of matter quickly gave rise to a study of the changes which substances can be made to undergo and of the structure of the resulting products. Each aspect of chemistry during the past 100 years is dealt with separately ; but the sequence of events nas been preserved so that the origin of each branch may be evident and the growth of each branch can be traced without confusion. In addition, the effect of the results of research upon everyday life has been considered. The industries which are based on the utilisation of coal tar derivatives, particularly the manufacture of dyestuffs, provides an especially interesting section for the general reader. The book closes with an outline of the various ways in which most chemical discoveries have proved to be of practical value in the commercial world. Those who have been responsible for the developments that are discussed are mentioned in the text merely by name ; biographical details are given separately as an appendix.

## Short Reviews

*First Studies from Great Britain* (C. C. CARTER and C. A. SIMPSON. Christophers, 2*s.* 9*d.*) is Book I in the *World of Man* series of geographies designed to cover the four years preceding an examination of university matriculation standard. Being a school-book, the consideration of economy of time and space was of the first importance ; and economy has been consulted without sacrifice of essential material. The aim of the series is to enable children to *think* geographically and to consider the various parts of the earth as geographical regions. The question " Why ? " must be combined with the question " Where ? " No one will quarrel with this aim, and this little text-book provides ample material for attaining it. The brief and concise text is supplemented by well chosen photographs, maps and diagrams ; and suggestive exercises form a useful appendix.

*Preparation of Mirrors for Astronomical Telescopes* (GEORGE MCHARDIE. Blackie, 3*s.* 6*d.*), in the publishers' handy *Technique* series, gives full instructions to amateurs for constructing that essential part of an astronomical telescope, the mirror. Amateur telescope-making is a hobby that has found many more enthusiasts in the United States than in the British Isles, and this small volume should do much to encourage British workers in this useful and pleasurable scientific field.

*Biology in the School.* (H. ALAN PEACOCK. Heinemann, 10*s.* 6*d.*) is a very honest book, concerned with the problem of introducing Biology as a subject in school time-tables, and with a discussion of the various possible syllabuses. Obviously the author has wide experience of his subject ; perhaps one can detect, as a sequel, a greater interest in curricula than in the minds of the pupils. But it is well that each man should write of what he fully understands, and pleasing to find to-day, when fools follow so gladly the fashion of deeply psychologising, a wise man handing on his less ethereal experience. Most scholastics now realise the necessity of biological teaching—in the abstract. This book will show them its concrete practicability.

*Composition for Photographers* (CHARLES SIMPSON. Witherby, 10*s.* 6*d.*) is a sectionalised enquiry into the bases of photographic construction, with frequent parallels from pictorial masters. It is illustrated by 38 plates, and also by a number of woodcuts in the body of the text which greatly assist the elucidation of the author's points. The chapter entitled " Landscape—Distance and Perspective " is especially helpful.

*Field Tests for Minerals* (E. H. DAVISON. Chapman & Hall, 7*s.* 6*d.*), with 56 pages of text and 12 plates will be found invaluable to all who have to handle minerals, either in the field or under investigation in the laboratory. The author has written it in the experience which has been gained during many years at the School of Mines, Camborne, Cornwall. The mineral specimens illustrated on the plates have been chosen with great care to show definite characteristics of structure, and are unequalled by any that have hitherto been published.

*Famous American Men of Science.* (J. G. CROWTHER. Secker & Warburg, 15*s.*) is a book with a misleading title ; it should have been "Four Famous American Men of Science," because it deals only with Franklin, Joseph Henry, J. W. Gibbs and Edison. It shows why Franklin created the modern theory of frictional electricity, what caused Henry to invent the first large electromagnet, the way in which a study of the theory of heat by Gibbs resulted in a theoretical basis for physical chemistry, and in the case of Edison the multiple causes that influenced the development of the quadruplex telegraph, electrical engineering, and the gramophone. The various relations between the problems which were chosen by each of these men and the social needs of their times are emphasised.

*Modern Glass Working and Laboratory Technique.* By M. C. NOKES. (Heinemann. 7*s.* 6*d.*)

In many modern pieces of apparatus, constructional efforts and repairs are greatly complicated by the necessity of making vacuum-tight joints between metal and glass. This book explains how this problem can be solved, and, in addition, it gives much useful information upon the working of glass in the laboratory generally. Instructions are given for dealing with Pyrex and other hard glasses. The fundamental operations of glass-blowing in the laboratory form the subject of one chapter which is especially well written and considered apart from the other portions of the book should be capable of conferring a wide range of manipulative power hitherto unenjoyed by the laboratory worker.

*Chemistry of Familiar Things.* (S. S. SADTLER. Seventh edition, revised ; Lippincott, 15*s.*) is a book originally written to meet the demand for an insight into chemistry by those whose training or reading had been directed in other channels. The author has dwelt at length upon the chemistry of the most familiar objects in nature, and many household substances. There are many interesting side issues which will appeal to the general reader, *i.e.*, phosphorescence and cosmic rays in the chapter on the chemistry and production of light. Elementary chemistry, to just sufficient extent, has been introduced in the first chapter to enable the reader to get a better understanding and appreciate the sequel.

*The Growing Child and its Problems* (edited by EMANUEL MILLER. Kegan Paul, 6*s.*) is another of those valuable books by a series of authors which will be of great interest to persons concerned in the upbringing of children from the age of five to the closing years of adolescence. Mr. Miller has grouped a series of seven articles on various problems appertaining to growing youth. All are worth careful reading and the book is one that should be in the hands of all those who realise their responsibility towards the child of to-day.

*Langes's Handbook of Chemistry* (Handbook Publishers Inc., Sandusky, Ohio, $6), now in its second edition, is a useful reference work for all who require ready access to chemical and physical data in the laboratory and in manufacturing. The new edition has over 1,800 pages of tables, and there is an unusually complete index (2,700 entries) to make it easy to find the information desired. Major revisions and new tables are considerable.

*How to Patent and Commercialize your Inventions* (D. B. MILLER. Pitman, 2*s.* 6*d.*) describes the practical steps that a British inventor should take to protect an invention. Formal procedure to comply with Patent Office requirements, patent agents' fees, manufacturers and markets, and the personal efforts of the inventor, are all dealt with in helpful manner. Various means by which an inventor can make small economies are pointed out. The author is a translator to the Institute of Patentees.

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